20MM AIRCRAFT GUN POD MARK 4 MOD 0

DESCRIPTION, OPERATION, AND MAINTENANCE

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FOREWORD

NAVWEPS OP 2719 (Volume 1) describes 20MM Aircraft Gun Pod Mk 4 Mod 0, and provides instructions for its operation and maintenance at the organizational level.

This publication consists of four volumes.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

SAFETY SUMMARY

INTRODUCTION

The weapons system described in this publication is fundamentally a safe ordnance system. For example, live rounds are isolated from firing circuits except when the weapon system is deliberately being fired. The weapon system is RADHAZ safe and completely shielded from radiation fields. Provision is made for charging and clearing the gun in flight, so the aircraft may take off and land without live rounds in firing position. Although the sole purpose of all ordnance is to destroy an enemy, the equipment cannot identify friend from foe. Therefore the meticulous observation of all safety precautions is MANDATORY at all times. The following summary is divided into general precautions and the special precautions applicable to the weapons system.

GENERAL PRECAUTIONS

The following general safety precautions are not related to any specific equipment or procedure, and therefore do not appear elsewhere in this publication. These precautions are recommended safety precautions that all personnel concerned must understand and apply during operation and maintenance of the equipment.

All persons who supervise or perform work in connection with the handling of ammunition shall be familiar with the Bureau of Naval Weapons safety precautions. Shore activities shall observe the requirements specified in OP 3347. Fleet activities shall follow the instructions specified by the bureaus concerned.

In every case where test firing is to be conducted with live ammunition, all existing range regulations shall be observed.

Before undertaking any operation such as loading, firing, test, unloading, disassembly, reassembly, overhaul, routine maintenance, or any other procedure for which a check-off list exists, the checkoff list shall be read thoroughly to assure complete understanding by all involved.

When provided, safety devices shall always be used to prevent the possibility of accidents, and shall be kept in good operating order at all times.

Changes, modifications, or additions to this weapon system shall not be made without the prior approval and explicit authorization from the bureaus concerned.

SPECIAL SAFETY PRECAUTIONS

The following special safety precautions are issued for the Gun Pod Mk 4 Mod 0, incorporating the 20MM Aircraft Gun Mk 11 Mod 5. These checks are MANDATORY for safe and effective tactical operation of the weapon.

1. Before connecting the aircraft electrical plug into the gun pod receptacle, make certain the master armament switch is off and that the ready switch is in the safe position.

2. Check that all safety wires are in place, and that the short ends are turned in to prevent injury to personnel.

3. Check the air supply to the Mk 11 gun. Keep hands away from moving parts when air pressure is on.

Ammunition

Additional precautions to be observed when ammunition is handled are:

1. Do not use ammunition in a gun for which it is not intended.

2. Use dummy ammunition only for drill.

3. Protect all ammunition against abnormally high temperatures.

4. Do not alter ammunition.

5. Live ammunition should be loaded into guns for firing purposes only. However the first two rounds loaded into the revolver cylinder chambers must be Mk 103 dummy rounds. Test or inspection of live ammunition by fitting it into guns is prohibited, except when specifically authorized by the Bureau of Naval Weapons.

6. Ammunition arming and de-arming procedures must be carefully followed to avoid accidental firing.

7. Never leave ammunition in a gun when through firing.

8. Observe fire regulations strictly.

Disassembly

The following precautions are to be observed when disassembly of the gun pod is undertaken.

1. Place the manually operated valve handle in the dump position to release pressure in the air hoses to the gun mechanism and loader.

2. Before removing any pneumatic component be sure that the portion of the system is depressurized.

Cleaning and Lubrication

The following precautions should be observed for the protection of personnel and equipment:

1. When working on any gun pod component, place it in a well-supported position so it will not fall.

2. Continued use of dry-cleaning solvent P-D-680, Type I, without gloves will dry the skin and may cause slight irritation. Rub grease or oil into the skin to replace natural skin oils.

3. Observe fire regulations when using flammable materials.

4. Always use the prescribed lubricant, unthinned.

5. Lubricants containing silicone are irritating to the eyes. Use caution in handling to avoid contact.

The following WARNINGS are repeated from the text for the protection of personnel.

WARNINGS

Fuzes shall not be disassembled. Any attempt to disassemble fuze in the field is dangerous and is prohibited. (Page 2-11)

Boresight tool must be removed before firing gun pod. (Page 3-5)

Although cartridge primers are designed to be fired by electrical impulses, it is possible that they also may be fired by high impact, static electricity, and exposure to electromagnetic energy. When loading HEI rounds into links use extreme caution to prevent impacts to the round that would damage the fuze. (Pages 4-3, 4-4 and 4-12)

The first two rounds following empty leading link must be either target practice (TP) or armor piercing (AP T) rounds. (Page 4-6)

Do not attempt to clear rounds from revolver cylinder in ROD HAZ area. (Page 4-9)

When using gun pod tester to test firing pin voltages, be sure that the charger valve electrical cable (1, figure 5-20) is not connected to the charger valve on forward end of Mk 11 gun. (Page 5-6)

Alert personnel in the area to the high frequency sound that results when the pneumatic motor is operated with no load. Do not operate pneumatic motor more than a fraction of a second. (Page 5-6)

When charging Mk 11 gun using gun pod tester, personnel are to stay clear of the central pod area during the succeeding operations. (Page 5-6)

Weight of the gun mechanism is approximately 190 pounds. During removal from the pod body, the gun mechanism must be supported. (Pages 5-8, 5-10)

Before disconnecting pneumatic lines or removing pneumatic components, pneumatic tubes and reservoir must be bled. (Page 5-13)

Recoil booster assembly push button (8) is spring loaded. Maintain pressure on push button while removing spring pin (7). (Page 5-20)

Avoid inhaling fumes from solvents. Avoid skin contact with solvent. Avoid directing compressed air against any part of body. (Page 5-30)

2. Check that all safety wires are in place, and that the short ends are turned in to prevent injury to personnel.

3. Check the air supply to the Mk 11 gun. Keep hands away from moving parts when air pressure is on.

Ammunition

Additional precautions to be observed when ammunition is handled are:

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Cleaning and Lubrication

The following precautions should be observed for the protection of personnel and equipment:

1. When working on any gun pod component, place it in a well-supported position so it will not fall.

2. Continued use of dry-cleaning solvent P-D-680, Type I, without gloves will dry the skin and may cause slight irritation. Rub grease or oil into the skin to replace natural skin oils.

3. Observe fire regulations when using flammable materials.

4. Always use the prescribed lubricant, unthinned.

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4. Always use the prescribed lubricant, unthinned.

5. Lubricants containing silicone are irritating to the eyes. Use caution in handling to avoid contact.

The following major CAUTIONS are repeated from the text because if not strictly observed the effectiveness of the equipment may be destroyed.

CAUTIONS

The gun pod and Mk 11 gun will function only with negative grounded dc power. (Page 2-25)

Do not charge after clearing because a link jam will occur. During clearing, the links in the loader do not advance. If the loader is re-engaged after clearing, there will be no rounds in the revolver to eject into and decouple these extra links. (Page 2-26)

Do not remove straps from gun pod until after ejector racks have closed on gun pod lugs, and the sear indicators show that gun pod is secured to the aircraft. (Page 3-3)

If link loading machine hangs up and rounds are properly positioned, do not adjust clutch. Refer to paragraph 5-63, fault isolation, and table 5-8. (Page 4-3)

Dummy rounds must be inserted far enough into revolver cylinder so latches (see figure 4-21 and 4-22) are aft of the cartridge cases. (Page 4-7)

Make certain all four forward latch pins are engaged on each feed chute. (Page 4-8)

Empty leading link must be positioned directly aft of the hand-loaded dummy cartridge. (Page 4-9)

Make certain clutch is re-engaged. (Page 4-9)

If aircraft control system is used for charging, disconnect electrical cable (2, figure 5-81) to prevent ammunition drive from pulling ammunition out of magazine during charge cycle. (Page 4-11)

Verify that polarity and ground connections are made correctly. (Page 5-4)

Do not actuate the TRIGGER switch for more than 10 seconds because of possible damage to transformers in the control box. Allow a minimum cooling period of one minute between operations. (Page 5-6)

Extensive and costly damage will result from high pneumatic motor speed resulting from more than momentary no-load operation. (Pages 5-6, 5-7)

When placing the gun pod tester gun switch to CLEAR and returning to SAFE, use care not to overtravel to the READY position. (Page 5-6)

Before reinstating barrels make certain ring seals in revolver cylinder are in place. (Page 5-8)

With nut (12, figure 5-22) tightened and no end play at the shaft, verify that magazine is free to rotate. (Page 5-41)



Figure 1-1. Three Gun Pods Mk 4 Mod 0 Installed on A4 Aircraft

CHAPTER 1
INTRODUCTION

1-1. CHAPTER CONTENTS.

1-2. This chapter presents the information required to understand the physical characteristics and operating capabilities of the 20MM Gun Pod Mk 4 Mod 0 and its supporting equipment. The information is presented in four categories: purpose; capabilities; system description; and reference data. Purpose includes a brief description of the basic equipment and its intended use. Capabilities provides a concise, tabulated statement of the capabilities and limitations of the equipment. System description consists of a graphical, nontechnical presentation that diagrams the functional relationship of equipment components. Reference data describes, in tabular form, the official designations, significant weights, dimensions, and operating characteristics of the equipment.

1-3. PURPOSE.

1-4. WEAPON SYSTEM. The aircraft gun pod weapon system described in this publication consists of the Gun Pod Mk 4 Mod 0, 20MM ammunition in the Mk 100 series, Mk 6 ammunition links, and gun pod support equipment.

1-5. SYSTEM APPLICATION. The gun pod is designed for installation on naval attack aircraft to provide air-to-ground attack capability for destruction of area and point targets (see figure 1-1). It also has a secondary air-to-air capability. Supplied in kit form, to match a particular aircraft, are aircraft attachment lugs and sway brace pads (see figure 1-2). Both 14 inch and 30 inch mounting capabilities are provided.

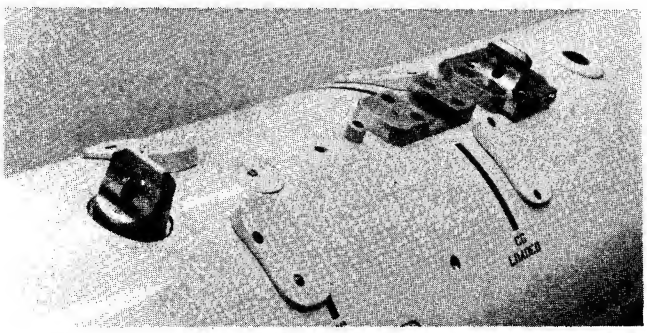


Figure 1-2. Typical Gun Pod Suspension Lugs and Sway-Brace Pads

1-6. SYSTEM FEATURES. The gun pod is a self-powered, self contained gun system capable of being installed, loaded ready to fire, on an external store mount on an aircraft. It features a supersonic shape, two rates of fire, automatic and manual charging, clearing, improved safety, and superior gun accuracy due to single mount harmonization and reduced reaction loads, and fires a 20MM 1700 grain projectile at a 3300 ft/second muzzle velocity at 4000 shots per minute. The gun pod features smooth-bore barrels for longer barrel life, and a nose configuration that provides an internal air flow for revolver cooling and a reverse flow within the barrels (breech to muzzle) for cook off protection. The barrels are quick-disconnect and can be removed without removing the gun from the pod. Removal of an empty gun pod and replacement with a loaded, exchange gun pod takes less than 10 minutes for faster-than-fueling turnaround during critical combat conditions. The gun pod may also be loaded after installation on the aircraft. The gun pod can be jettisoned in an emergency.

1-7. <u>System Nomenclature</u>. The Gun Pod Mk 4 Mod 0 is composed of the 20MM Aircraft Gun Mk 11 Mod 5 and the pod assembly. The 20MM Aircraft Gun Mk 11 Mod 5 fires 20MM ammunition in the Mk 100 series, belted with 20MM Ammunition Links Mk 6 Mods 4, 5, and 6. Refer to table 1-2 for the official designations of major components making up the aircraft gun pod weapon system. Refer to the block diagram shown in figure 1-3 for their relationship.

1-8. <u>Pod Assembly</u>. The pod assembly is a streamlined, lightweight container which houses the Mk 11 gun and 750 rounds of belted 20MM ammunition. The pod assembly is composed of the pod body, the pod nose, and the pod tail (see figure 1-4). Five active subsystems and one passive subsystem are contained within the pod body. The five active subsystems are the pod body structure; the gun pod electrical system; the gun pod pneumatic system; the ammunition feed system; and the ammunition magazine. The passive subsystem is referred to as a ghost system because it has no parts and no formal name. Its function is to control combustible gun gases released into the pod assembly by the Mk 11 gun. The gases are allowed to ignite and burn at random; gas pressure is relieved by louvers in the main access doors and in other skins in the pod assembly. Pod body components include feed chutes and ejection tubes. The pod nose incorporates a blast suppressor (see paragraph 2-10) and air ducts which match mating ducts on the gun for revolver cooling.

1-9. <u>20MM Aircraft Gun Mk 11 Mod 5</u>. The 20MM Aircraft Gun Mk 11 Mod 5 is composed of the 20MM Gun Loader Mk 2 Mod 1 and the 20MM Gun Mechanism Mk 11 Mod 5. The 20MM Gun Barrel Mk 19 Mod 3 and the 20MM Gun Barrel Mk 20 Mod 3 are smooth bore and parts of the gun mechanism. Projectile stability is provided by prespinning the projectile within the revolver to 130,000 rpm prior to barrel entry. The Mk 11 gun is a twin-barrel, air-cooled, belt-fed, combination gun gas and recoil-operated automatic gun, firing electrically primed ammunition from an eight-chamber cylinder. The revolver cylinder revolves about the horizontal centerline of the two

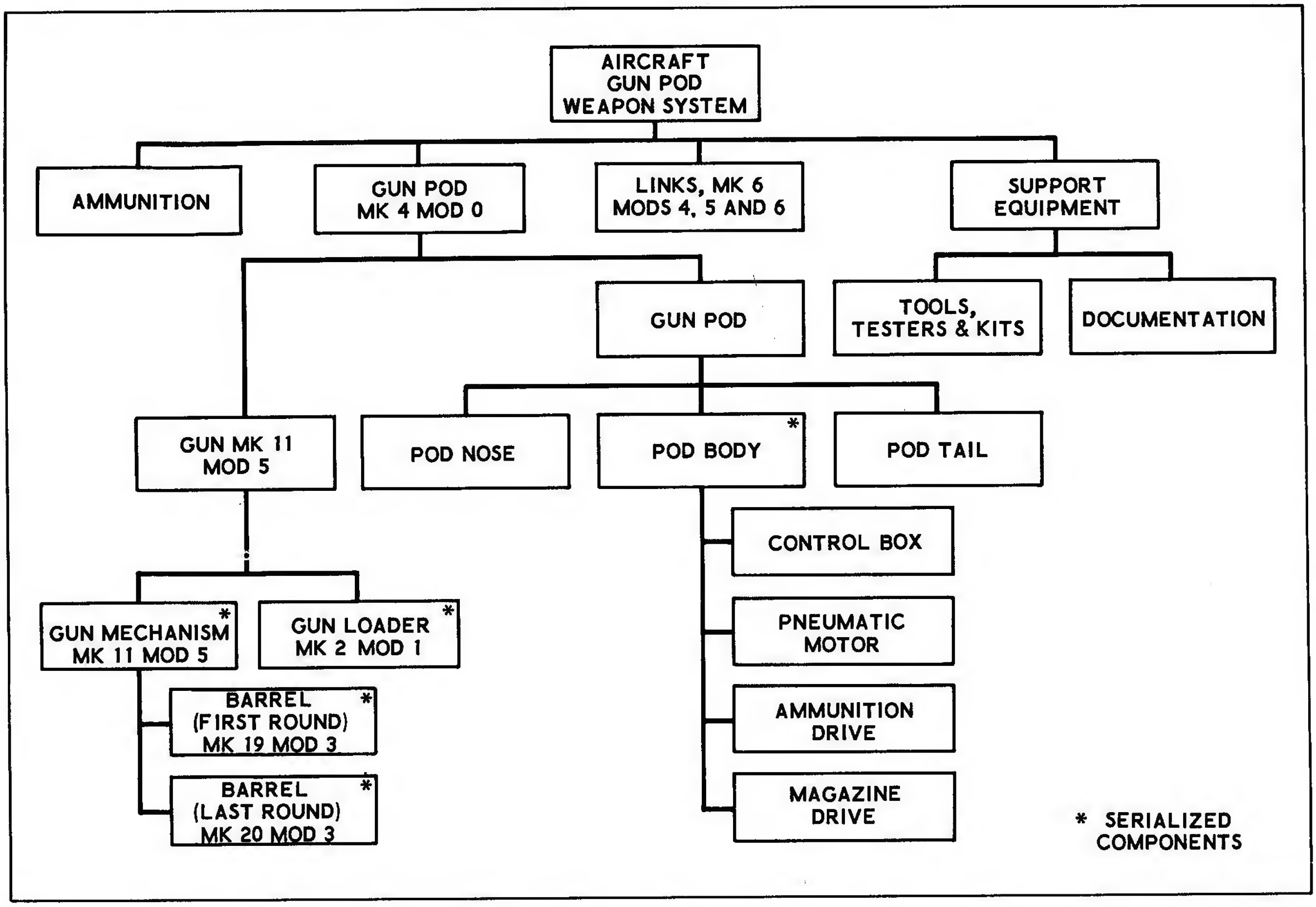


Figure 1-3. System Block Diagram

barrels. The Mk 11 gun is charged pneumatically by a 1500 psi system regulated from a 3000 psi reservoir contained in the pod body, is fired electrically from switches in the aircraft cockpit, and is controlled by relays in the pod body. The Mk 11 gun has a selective rate of fire, which may be set at either 4000 rounds per minute or 700 rounds per minute, and reaches full rate of fire instantaneously to deliver maximum projectile density on short-burst targets.

1-10. Ammunition and Links. The Mk 11 gun fires the 20MM Ammunition Mk 100-Series Cartridge which is retained by the 20MM Cartridge Link Mk 6 Mods 4, 5, and 6. The links are connected together to form belts, with the cartridges being inserted into the belts by use of a 20MM Link Loader Machine Mk 11 Mod 0. The loaded belts are carried within the ammunition magazine in the gun pod, from where they are conveyed to the Mk 11 gun by the ammunition feed system.

1-11. Support Equipment. The support equipment of the aircraft gun pod weapon system consists of this publication, three other volumes of gun pod documentation, attack aircraft documentation, and the tools and test equipment listed in tables 4-1 and 5-1. A Maintenance Requirement Card (MRC) set is available as additional documentation for routine maintenance. In those instances where a conflict exists between the manuals and the MRC set, the MRC shall prevail.

1-12. CAPABILITIES.

1-13. Capabilities, limitations and power requirements of the equipment are presented in table 1-1.

1-14. SYSTEM DESCRIPTION.

1-15. The relationship of system components to the other components of the equipment is described graphically in figure 1-3. The manner in which system components operate in respect to the other components of the equipment is described in Chapter 2.

1-16. REFERENCE DATA.

1-17. Basic reference information about the equipment is presented in table 1-2.

1-18. SERIALIZATION. It is to be noted that the gun pod is not serialized; i.e., does not have a serial number for records accountability. Several of the gun pod's components are serialized so that accountability can be maintained during the service life of the equipment. These components are: pod body, gun mechanism, barrels, and loader.

NOTE: These serial numbers shall be included in equipment reports (refer to paragraph 5-2).



Figure 1-4. Gun Pod on Mk 7 Bomb Trailer

TABLE 1-1. GUN POD MK 4 MOD 0 CAPABILITIES

Capabilities	
Firing Rate:	
Fast	4000 ± 200 rounds/minute
Slow	700 ± 100 rounds/minute
Time to rate	Instantaneous
Projectile energy:	
Rate	5000 horsepower
Density	22 hp/lb of Mk 11 gun
Muzzle velocity	3300 ± 50 ft/sec
Capacity	750 rounds
Limitations	
Airspeed during firing	
Mach 1.2	10,000 ft altitude
Mach 2.2	60,000 ft altitude
Load tolerances:	
Vertical	10 g
Side	6.5 g

TABLE 1-1. GUN POD MK 4 MOD 0 CAPABILITIES (Continued)

Limitations (Continued)	
Load tolerances: (Cont.)	
Catapult	9 g
Arresting	9 g
Firing (under acceleration)	6 g
Power Requirements	
AC	120 volt, 400 cycle
Current (maximum line)	6.4 amperes (peaks during firing of bursts)
DC	28 volt, negative-grounded
Current (maximum)	7.0 amperes maximum (intermittent during firing) and 0.3 amperes at standby
Pneumatic reservoir	3200 ± 200 psig
Operating pressure	1500 psig

TABLE 1-2. REFERENCE DATA

Nomenclature	
Official Designation	Abbreviated Designation
Gun Pod Mk 4 Mod 0	Gun Pod
Gun, Aircraft, 20MM Mk 11 Mod 5	Mk 11 Gun
Gun Mechanism, 20MM Mk 11 Mod 5	Gun Mechanism
Gun Loader, 20MM Mk 2 Mod 1	Loader
Cartridge, 20MM, Electric; Mk 100 Series	Rounds
Link, Ammunition, 20MM Mk 6 Mod 4	Link
Link, Cartridge, 20MM Mk 6 Mod 5 (leading)	Leading Link
Link, Cartridge, 20MM Mk 6 Mod 6 (trailing)	Trailing Link
Machine, Link Loading, Mk 11 Mod 0	Link Loading Machine
Barrel, Gun, 20MM Mk 19 Mod 3 (First round barrel)	First Round Barrel
Barrel, Gun, 20MM Mk 20 Mod 3 (Last round barrel)	Last Round Barrel
Operating Characteristics and Features	
Gun Pod Mk 4 Mod 0:	
Structure	Semi-monocoque
Gun Mk 11 Mod 5:	
Type	Twin-barrel, revolver
Operation	Combination gas-recoil
Cooling	Air
Headspace	Fixed
Charging	Pneumatic
Firing	Electrical impulse
Case ejection	Rear of loader at 100 ft/sec
Direction of feed	Both sides of loader

TABLE 1-2. REFERENCE DATA (Continued)

Operating Characteristics and Features (Continued)	
Gun Mk 11 Mod 5 (Cont.)	
Barrel mounting	Interrupted locking lug (quick disconnect)
Barrel type	Smooth bore
Accuracy	A radial dispersion of 6 mils per barrel for 80% of projectiles
Recoil loads at pod mounts	
Peaks	8000 lbs recoil
	5000 lbs counter-recoil
Average	2500 lbs
Ammunition:	
Primer	Electrical ignition
Link	End-stripping, metallic
Link belt pitch	1.60 in.
Weights and Dimensions	
Center of gravity:	
Fully loaded	21.6 in. aft of fwd lug (30 in.)
Magazine empty (no air)	5.6 in. aft of fwd lug (30 in.)
Gun Pod Mk 4 Mod 0	
Fully loaded (with air)	1390 lbs
Magazine empty (no air)	787 lbs
Without gun	547 lbs
Gun Mk 11 Mod 5	240 lbs
Gun Mechanism Mk 11 Mod 5:	
With barrels	195 lbs
Without barrels	142 lbs
Gun Loader Mk 2 Mod 1	45 lbs
Ammunition:	
750 rounds, linked	594 lbs
Gun Pod Mk 4 Mod 0:	
Overall length	191.35 in.
Diameter	22.50 in.
Center section	101.12 in.
Nose section length	46.89 in.
Tail section length	43.34 in.
Gun Mk 11 Mod 5:	
Overall length	78.50 in.
Mechanism length (no barrels)	32.6 in.
Loader length	22.00 in.
Barrels	56.50 in.

CHAPTER 2
DESCRIPTION

2-1. DESCRIPTION.

2-2. This chapter presents the information required to understand the physical configuration of the equipment and the way the equipment performs its functions. The information is presented in three categories: physical description (paragraph 2-3), general functional description (paragraph 2-35), and detailed circuit analysis (paragraph 2-86). Physical description consists of a concise description of the significant physical details of the equipment. General functional description provides an overall understanding of the way the equipment functions. Detailed circuit analysis describes all complex circuits and how they accomplish their functions.

2-3. PHYSICAL DESCRIPTION.

2-4. GUN POD MK4 MOD0. The Gun Pod Mk 4 Mod 0 is a fabricated, cylindrical container within which are housed the systems, subsystems, and components necessary for its function (see figure 2-1). The gun pod-to-aircraft attachment fittings and sway brace pads (which are supplied in kit form) are positioned on the outside of the gun pod at the top. The dimensions of the gun pod are given in table 1-2. The relationship between the gun pod, systems, subsystems and components is shown in figure 1-3.

2-5. GUN MK 11 MOD 5. The Mk 11 gun (see figure 2-2) consists of a gun mechanism and a loader which

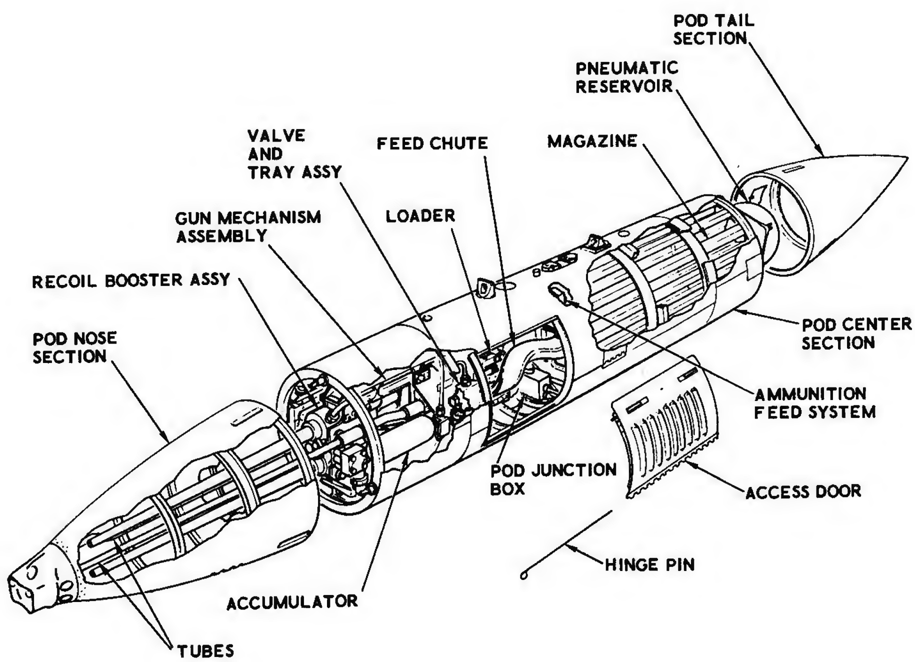


Figure 2-1. Gun Pod Mk 4 Mod 0 with Gun Mk 11 Mod 5

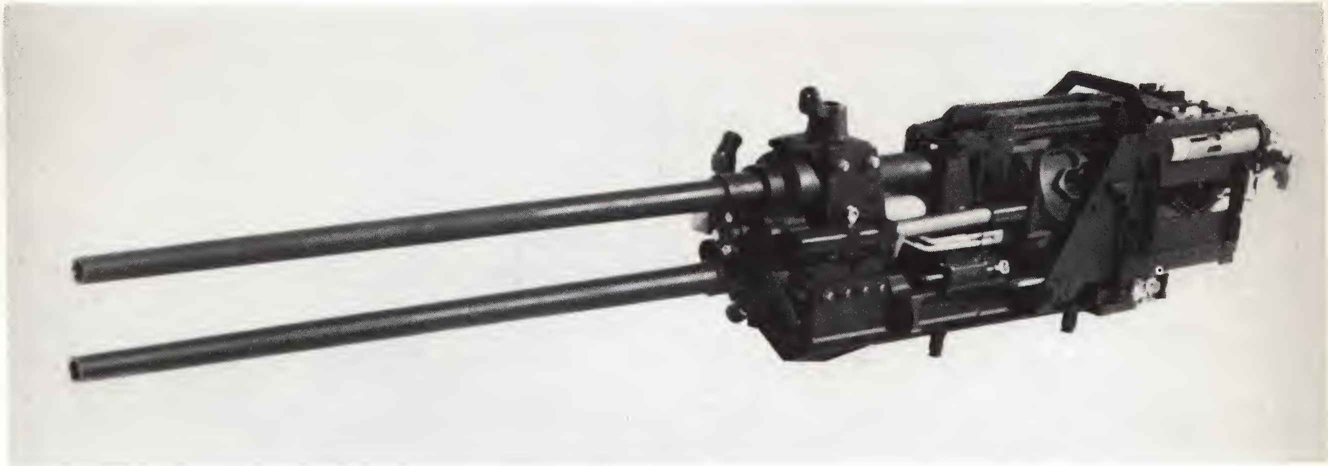


Figure 2-2. Gun Mk 11 Mod 5

together weigh 240 pounds and are 78.5 inches long with barrels installed. The gun mechanism is located forward of the loader, and its barrels project into the pod nose section. The loader is mechanically connected to the rear of the gun mechanism. The Mk 11 gun has two main mounting holes (which engage the locking pins of the pod trunnion mounts) built into the front upper and lower surface of the receiver. The receiver also incorporates two flanges for aft support, which slide into keyways riveted to the gun pod at the forward end of the main access doors. The two barrels incorporate interrupted locking lugs which mate with lugs in the forward portion of the breech. The barrels are secured by flats on the booster block assembly which prevent the barrels from turning. The barrels are removed by removing the booster block assembly which in turn is held in place by a single lever operated quick-disconnect.

2-6. Gun Mechanism Mk 11 Mod 5. Basic components of the gun mechanism (see figures 2-3 and 2-4) are divided into non-recoiling parts and recoiling parts. The non-recoiling parts consist of a receiver, which is the basic frame of the gun mechanism (and to which other components are attached), a booster housing assembly, a counter recoil damper assembly, a cylinder shaft, a charger valve, a gun sequence switch, a gun junction box, eject tubes (gun gas and air), and air cooling tubes. The recoiling parts are in or attached to the breech assembly which slides along the receiver. The breech mounts the revolver cylinder, firing pins and holder, cam followers and slider, barrels, and miscellaneous small hardware. The barrels are attached to the breech, with one above the other in normal operating position. The eject tubes and air cooling tubes are stationary but coupled to the recoiling breech assembly with slip joints to their corresponding supports. The gun junction box is mounted on the receiver, and contains the gun electrical connectors. The gun sequence switch is electrically connected to the gun junction box but is mounted on the receiver rail. Electrical contacts on the gun junction box conduct firing impulses to matching contacts in the firing pin holder. Timing is achieved by the relative motion between the two sets of contacts from breech movement during gun cycling. Electrical continuity to the firing pins is integral within the firing pin holder.

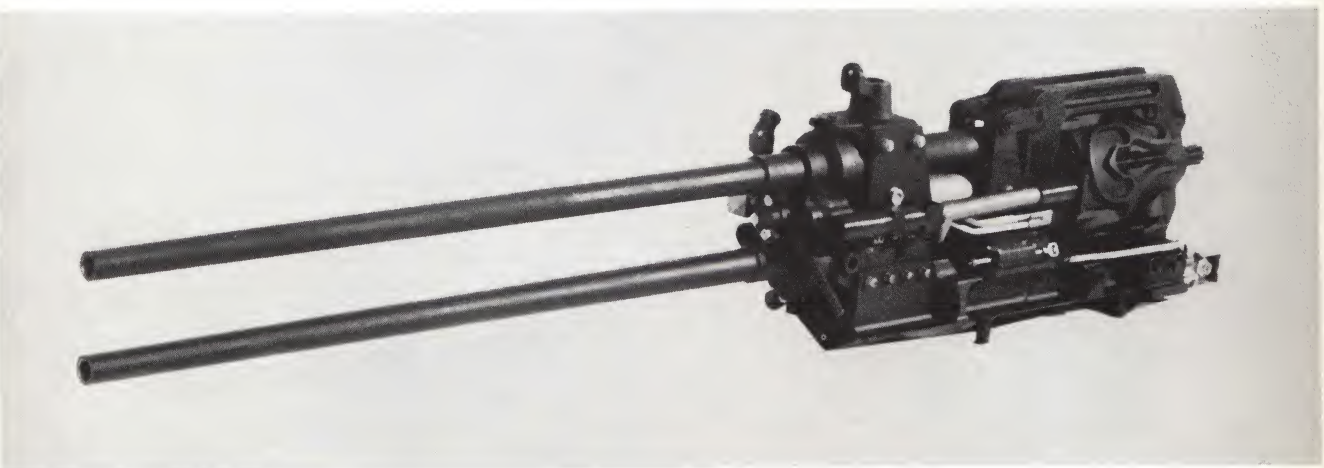


Figure 2-3. Gun Mechanism MK 11 Mod 5

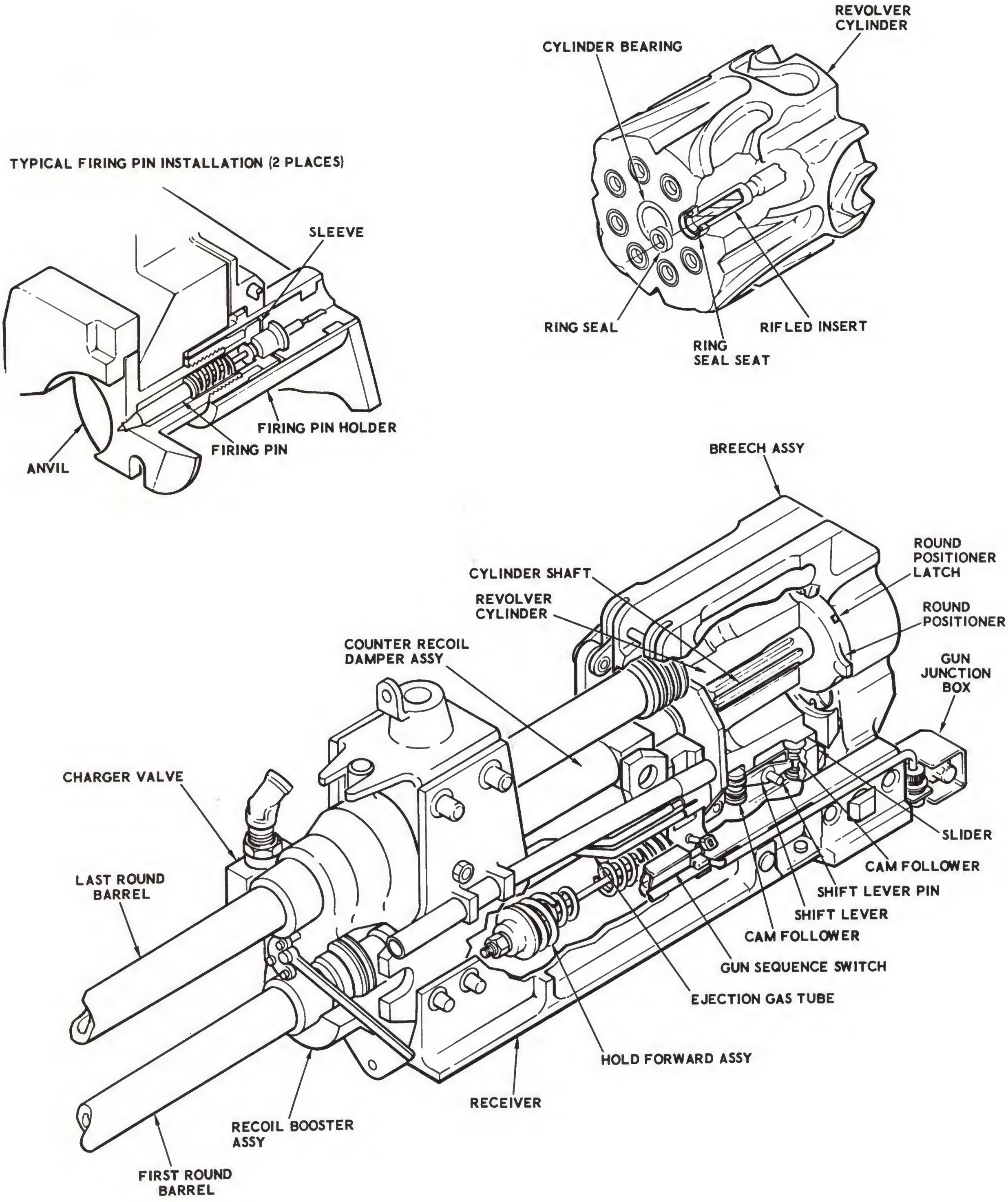


Figure 2-4. Gun Mechanism Mk 11 Mod 5, Cut-away View

2-7. <u>Gun Loader Mk 2 Mod 1</u>. The loader (see figures 2-5 and 2-6) which feeds the gun mechanism includes two ramming mechanisms which project rounds into the revolver, a set of sprockets that draws the belt into the loader and a pneumatic clutch that decouples the loader functionally from the gun mechanism for gun clearing. These components are installed in the loader frame which mounts to the gun mechanism by quick-release fastenings.

2-8. The loader frame is approximately square in cross section. The ramming mechanisms are at the upper left and lower right corners and are connected at the rear by a manifold that ducts either air or gun gas to the rammers for actuation. Oscillating guides are located at the opposite corners and direct expended cases into ammunition links during ejection. Ejection ports are directly aft of the eject stations and the oscillating guides to permit passage of links and cases from the Mk 11 gun. Two solenoid valves are mounted on the aft side of the loader to direct air for ramming during charging or to actuate the decoupling clutch during clearing.

2-9. POD ASSEMBLY. The pod assembly features conventional aircraft construction practice, being made up of stressed aluminum sheet flush-riveted to annular formers, bulkheads, and formed ribs, stiffened by webs, gussets, castings, and forgings. Stainless steel sheet and bar stock is used in critical areas. The bottom of the structure is reinforced for cradling and hoisting from 14 inches forward of the forward lug to 16 inches aft of the aft lug.

2-10. The pod assembly is divided into three sections: a main center section or pod body, a pod nose, and a pod tail (see figure 2-1). The nose and tail sections connect to the pod body by quick-release latches. The pod body contains all systems, subsystems and components of the gun pod except for the blast suppressor and cooling ducts which are incorporated into the nose section. In addition to housing major components, the pod body is equipped with mounting hardware for the gun mechanism, support structure for the ammunition magazine, and support structure for the feed, pneumatic, and electrical systems. The pod body is also equipped with provisions for attaching suspension lugs (for mounting the gun pod to aircraft), two removable main access doors, two inspection doors, two inspection windows, and latch pins to which the pod nose and pod tail sections are attached.

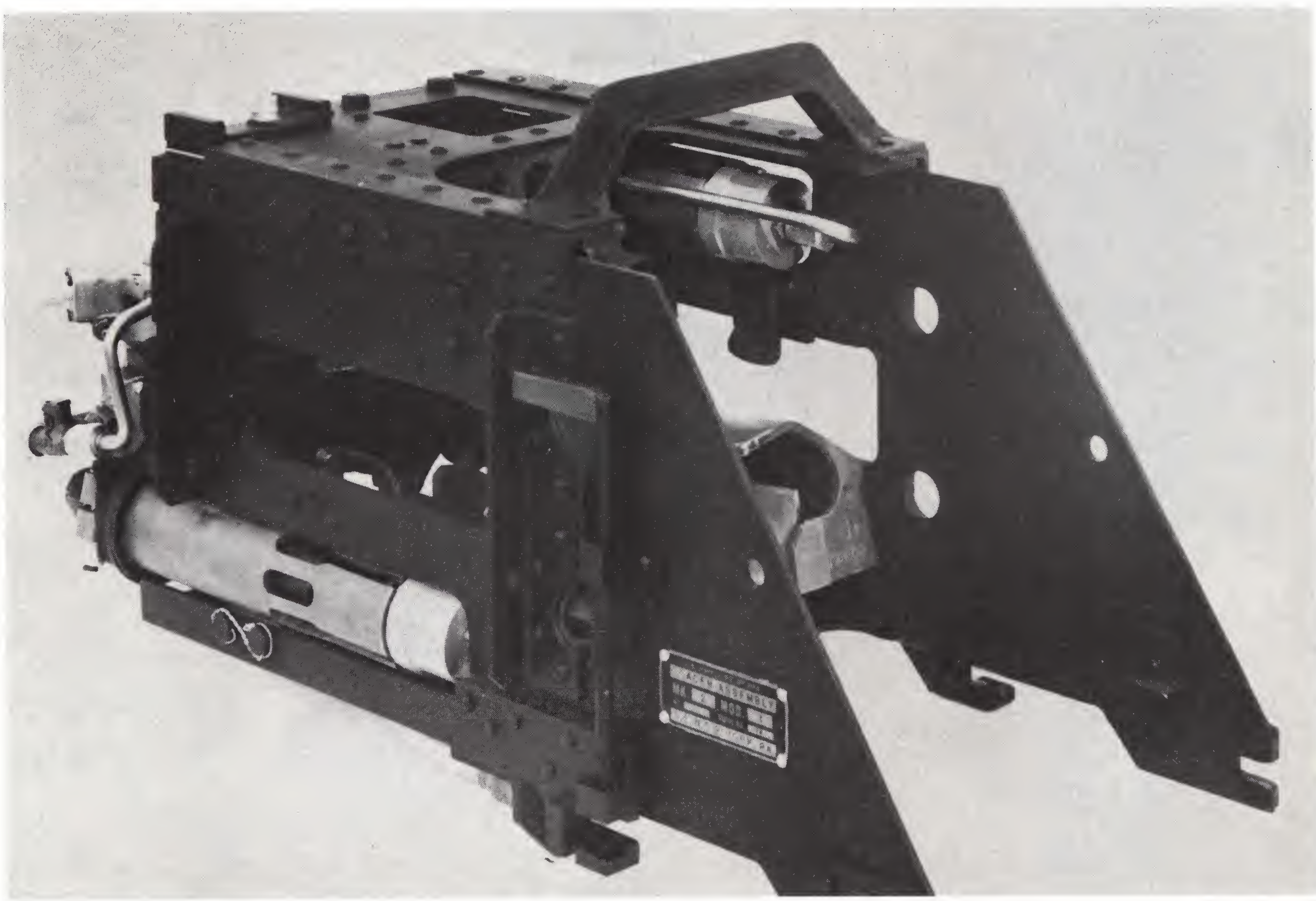


Figure 2-5. Gun Loader Mk 2 Mod 1

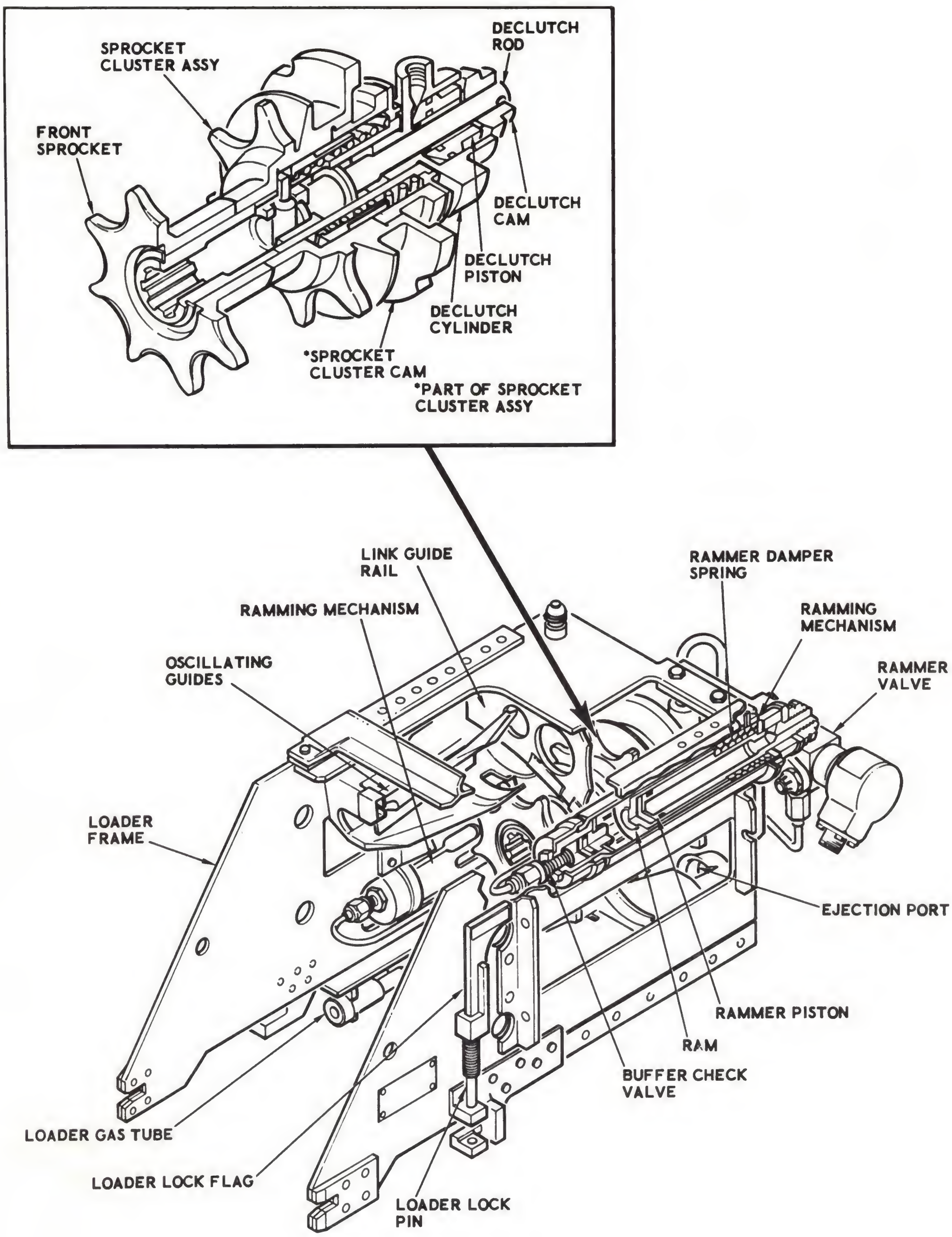


Figure 2-6. Gun Loader Mk 2 Mod 1, Cut-away View

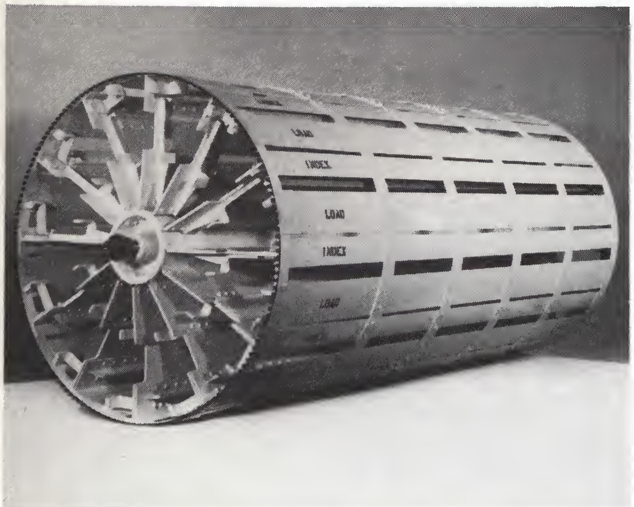


Figure 2-7. Ammunition Magazine



Figure 2-8. Mk 6 Links Loaded with TP Ammunition

2-11. Ammunition Magazine. The ammunition magazine (see figure 2-7) is located aft of the Mk 11 gun at the rear of the pod body. The magazine is cylindrical and has 12 wedge-shaped compartments into each of which a single loop of belted ammunition is loaded (refer to paragraph 2-70). A pair of hooks is provided at the forward end of each compartment to position the ammunition during loading. The outer surface of the magazine is composed of longitudinal panels on which are alternately marked LOAD and INDEX for loading and readying for firing. The magazine has a circumferential ring gear and attaching hardware which attaches the magazine at its forward end to a pod body bulkhead.

2-12. Ammunition Belts. Ammunition is conveyed to the Mk 11 gun by two belts of Mk 6 links. Each link is cylindrical in shape, and has a RADHAZ cap which protects the ammunition primer from electromagnetic radiation. The links are connected together by means of hook shaped lugs which engage rivets on adjoining links. Each lug is held in position by the clamping action of a C spring which partially envelops and grips the lug. Links loaded with TP ammunition are shown in figure 2-8. The belted links are loaded with ammunition and are fed into the magazine. Each belt fills six adjoining compartments when the magazine is fully loaded.

2-13. Feed System. The feed system is defined as those components necessary to transport the ammunition from the magazine to the loader. The feed chutes are not included, since they are considered as separate items. The feed system includes the throats, sprockets, adapters, sprocket support, and the ammunition feed mechanism.

2-14. The throats funnel the ammunition from the magazine segments to the inner adapter. The inner adapter mounts the outer adapter which has approximately the same cross sectional shape as the feed chute. The feed chute in turn attaches to this outer adapter. A set of sprockets is mounted above each throat by sprocket supports. The sprockets engage the ammunition belt in the throat as it leaves the magazine.

2-15. The ammunition feed mechanism provides the power to drive the sprockets and to drive the magazine in rotation. The feed mechanism consists of a pneumatic motor and two gear trains and is mounted by three bolts to the bulkhead just aft of the main access doors. One gear train drives the sprockets; the other, through a decoupling spline, drives the magazine. The decoupling feature permits separating sprocket rotation and magazine rotation during loading.

2-16. Feed Chutes. Two feed chutes are employed for guiding the ammunition from the throats, just forward of the magazine, to the loader. The chutes are rigid, identical in shape, and are located inside the main access doors. The chutes are keyed to a slot at the throat adapter and are latched in place both at the adapter and at the loader side plates by quick-disconnect fittings. The chutes are removable for reloading the magazine. Should belts remain in the chutes, removal of the chute automatically decouples the belt.

2-17. Ejection Tubes. Two ejection tubes, which are installed between the loader and the pod structure, are used for ducting spent cases and links overboard. The tubes are of different lengths and easily mounted in place.

2-18. Pneumatic System. The pneumatic system is composed of a reservoir, an accumulator, a valve and tray assembly, and interconnecting tubing. Other pneumatic components (solenoid operated valves, air motor) are considered part of the systems to which they are attached. The spherical reservoir has a volume of 1150 cubic inches. Pressurized at 3400 psig, it has a volume of approximately 135 cubic feet of standard air. The reservoir is attached to the aft end of the pod body. It is equipped with a fill valve and pressure gage. The cylindrically shaped accumulator of 96 cubic inch capacity is attached with bolts and a clamp in the forward portion of the pod body. The valve and tray assembly is mounted just aft of the accumulator and consists of a valve assembly, a pressure regulator (set to 1500 psi), and mounting tray. The valve and tray assembly is attached to

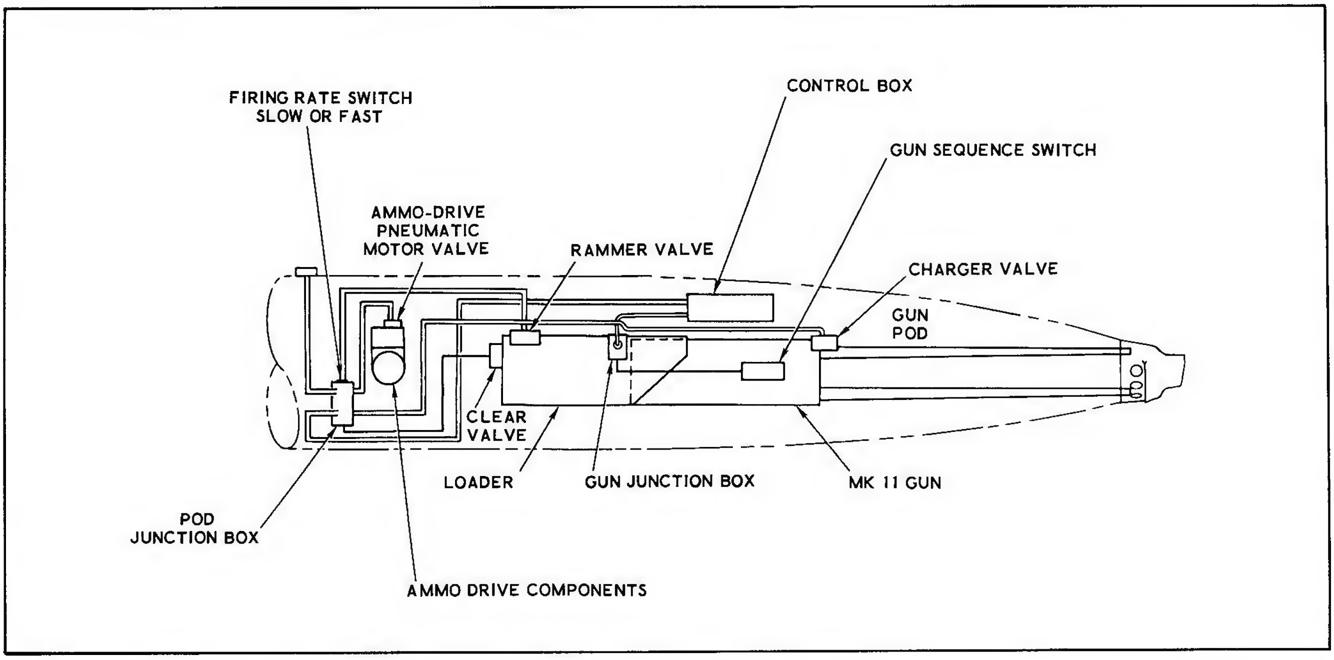


Figure 2-9. Electrical System Diagram

the gun pod structure with 4 bolts and 3 screws. Pneumatic quick disconnects and flexible hoses are used for connections between the gun pod and the Mk 11 gun and loader. (See figure 2-31 for schematic diagram.)

2-19. Electrical System. The electrical system (see figure 2-9) is composed of a control box, a pod junction box, a single external electrical receptacle and connecting conduits. The receptacle is at the top of the gun pod structure and connects to the aircraft's electrical cabling for cockpit control. The control box is located forward in the pod body and secured to the gun pod with shock mounts. The pod junction box is located near the center of the pod body on the vertical center line below the feed throats, and is secured to the gun pod with 4 nuts. The screws attaching the pod junction box are visible only when the pod junction box cover is removed. Electrical quick disconnect connectors are used throughout the gun pod. All electrical cables are encased in flexible metal conduit to shield circuits from RADHAZ, heat, and handling abuse.

2-20. Cook-off Control, Blast Control, and Cooling Systems. Cook-off control, blast control, and gun cooling is provided by utilizing common components from several subassemblies of the pod. The systems include the blast suppressor in the nose, air ducts in the nose, air ducts mounted on the gun mechanism and the louver configuration in the main access doors. The components are not considered as a part of the system but as parts of the assemblies to which they attach (see paragraph 2-77).

2-21. The blast suppressor is a single piece stainless steel casting which is mounted at the forward end of the pod nose by 6-3/8 inch diameter studs. It is made in two compartments or plenum chambers, each of which has an inlet to locate the muzzle of the barrel and an in-line outlet for projectile emergence. Each plenum chamber also has vents behind a louver which direct gun gas and blasts away from the top of the pod. Forward of the two chambers is an aerodynamic fence and inlets for two air ducts. The inlets are ducted straight through the casting.

2-22. Coupled to the cast inlets are two aluminum alloy tubes. The tubes are mounted by flanges to two vertical structures at the aft end of the pod nose. These structures also prevent nose installation unless the barrels and trunnions are locked.

2-23. The two tubes of the nose match and slip into place into two ducts mounted on the gun mechanism when the nose is attached to the pod body. The air ducts on the gun, together with those in the nose, provide a continuous air duct from the extreme front of the nose to the two revolver chamber stations that are always empty.

2-24. The louvers of the main access doors are directed forward rather than the more normal aft position. The configuration is important for proper pressure distribution for cook-off control.

2-25. AMMUNITION. The ammunition fired by the Mk 11 gun is issued in the form of complete rounds of fixed ammunition. (See figures 2-10 through 2-17.) The cartridges are the 20MM Ammunition Mk 100 series, and are belted into Mk 6 links Mod 4 (Mods 5 and 6 are leading and trailing links, respectively) when used in the gun pod. The cartridges are inserted into the link-belts by use of a 20MM Link Loading Machine Mk 11 Mod 0.

2-26. The complete round contains propelling powder loosely assembled in a steel cartridge case and the neck of the case is crimped rigidly to the projectile. The projectile is 0.784 inch in diameter. The cartridge case tapers from 1.04 inches diameter near the neck to 1.165 inches diameter at the rim. The complete cartridge weighs approximately 0.59 pound.

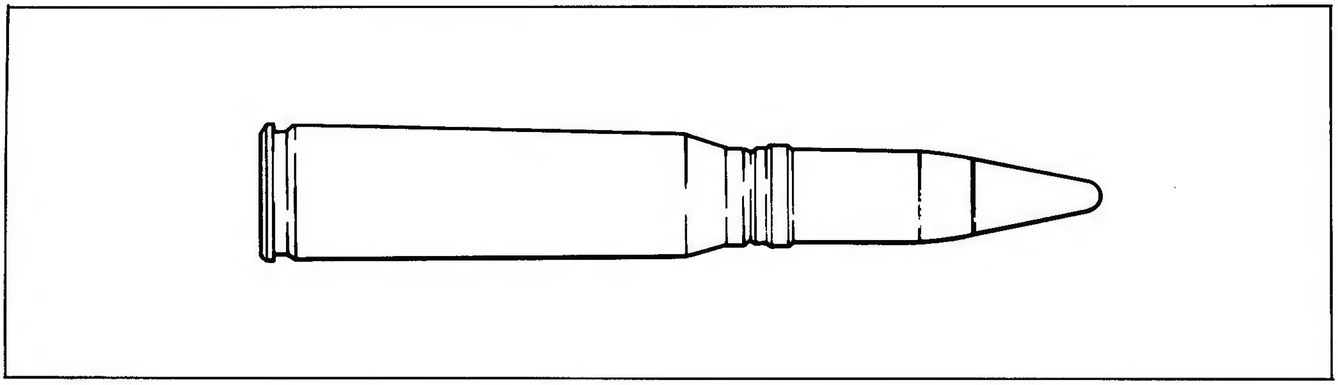


Figure 2-10. Complete Round for 20MM Aircraft Guns Mk 11 and 12

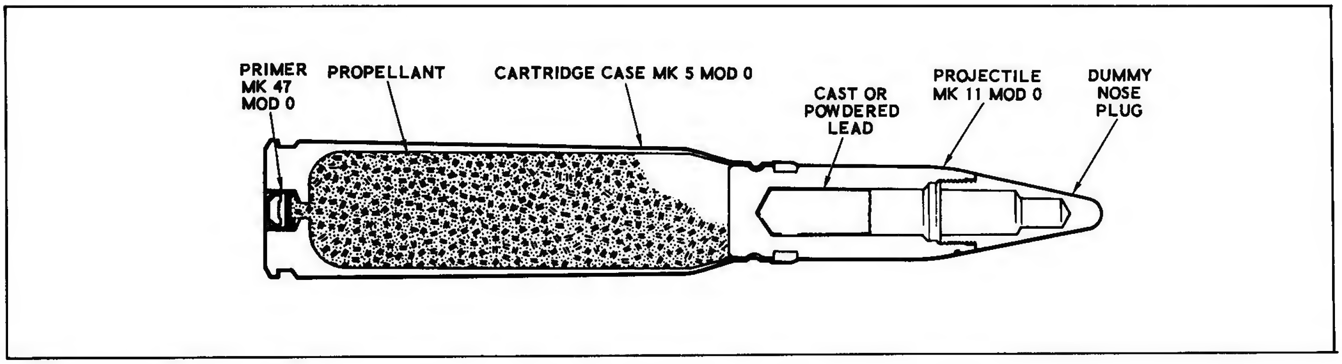


Figure 2-11. HPT Round Mk 101 Mod 0, Section View

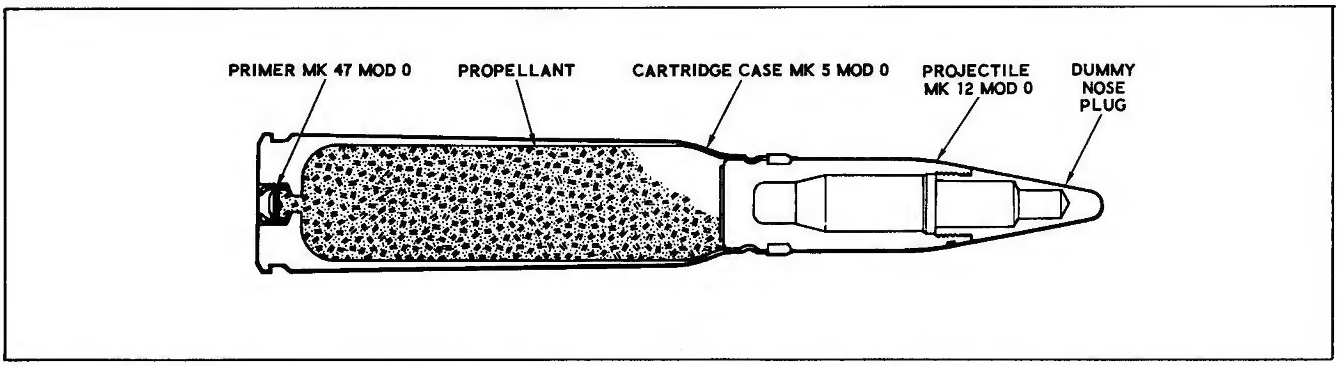


Figure 2-12. LPT Round Mk 102 Mod 0, Section View

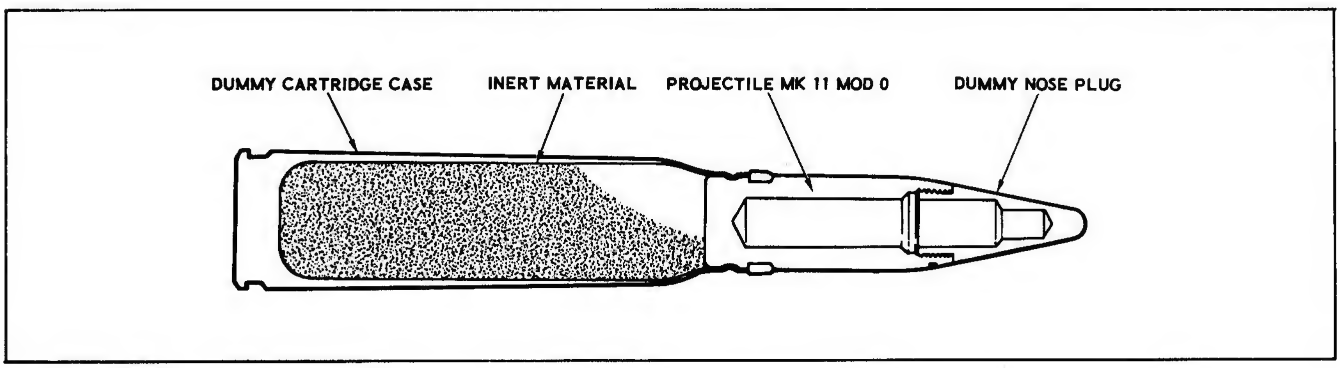


Figure 2-13. Dummy Round Mk 103 Mod 0, Section View

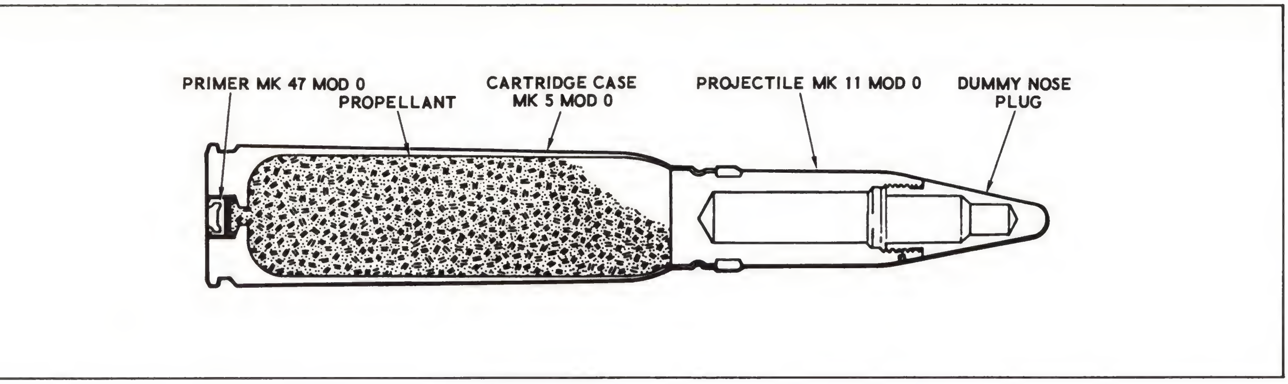


Figure 2-14. TP Round Mk 105 Mod 0, Section View

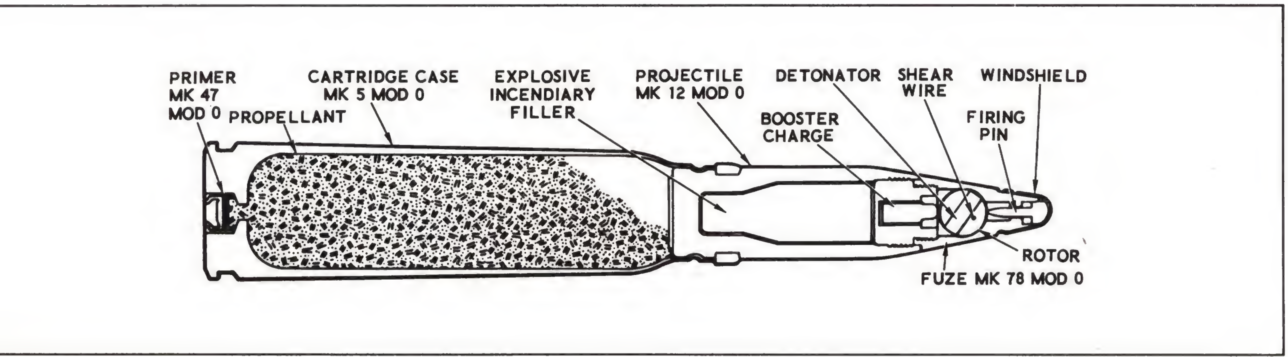


Figure 2-15. HEI Round Mk 106 Mods 0 and 1, Section View

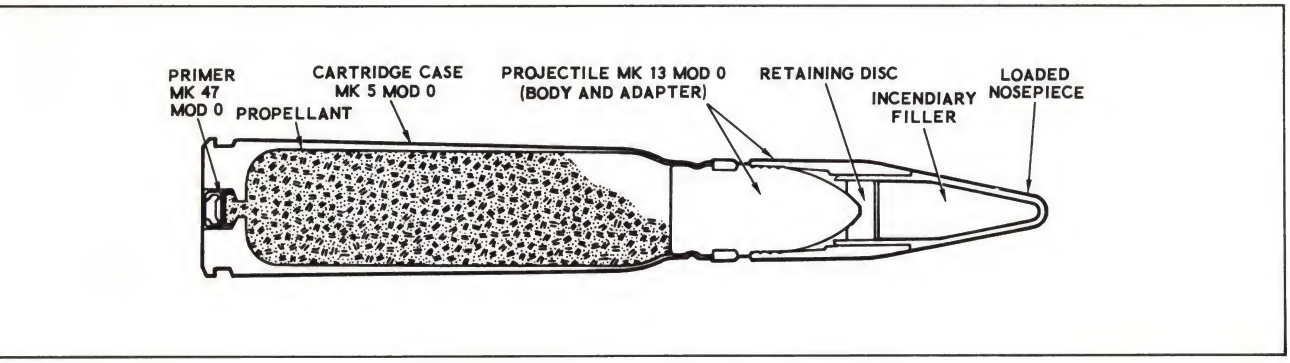


Figure 2-16. API Round Mk 107 Mod 0, Section View

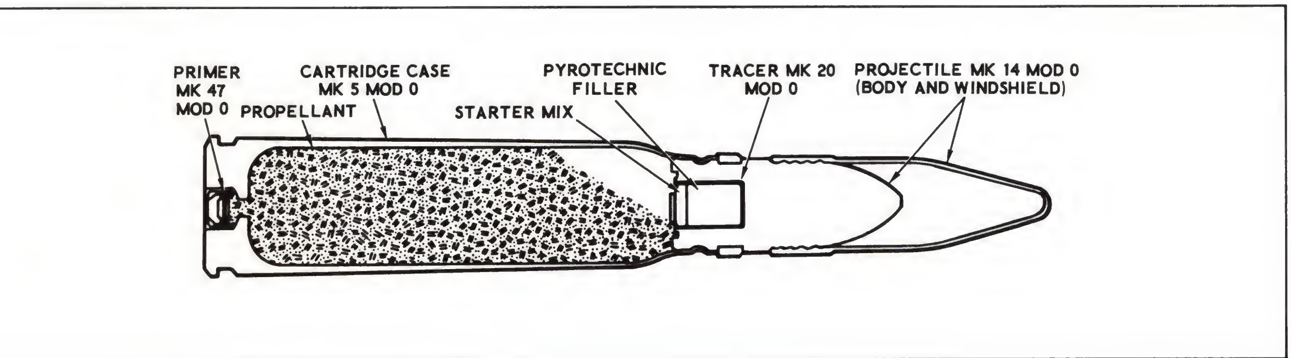


Figure 2-17. AP T Round Mk 108 Mod 0, Section View

All types have matched ballistics, are electrically primed, and the shape, length, and weight are approximately the same.

2-27. Rounds are classified as dummy, high pressure test (HPT), low pressure test (LPT), target practice (TP), high-explosive incendiary (HEI), armor-piercing incendiary (API), armor-piercing with tracer (AP T), and firing circuit test.

2-28. The ammunition currently issued is identified as follows:

1. High Pressure Test (HPT) Round Mk 101 Mod 0 (see figure 2-11).

2. Low Pressure Test (LPT) Round Mk 102 Mod 0 (see figure 2-12).

3. Dummy Round Mk 103 Mod 0 (see figure 2-13).

4. Target Practice (TP) Round Mk 105 Mod 0 (see figure 2-14).

5. High Explosive Incendiary (HEI) Round Mk 106 Mods 0 and 1 (see figure 2-15).

6. Armor Piercing-Incendiary (API) Round Mk 107 Mod 0 (see figure 2-16).

7. Armor Piercing-Tracer (AP T) Round Mk 108 Mod 0 (see figure 2-17).

2-29. The principal components used in this ammunition are a projectile, cartridge case, propellant, primer, fuze, and tracer. Only the high explosive incendiary round is fuzed. The dummy rounds contain no explosive.

2-30. Identification. Ammunition is identified by the color that the projectile is painted and by 1/8-inch lettering on the body of the projectile. Rotating bands and nose fuzes are never covered with paint. The lettering is stenciled in waterproof marking ink around the body of the projectile after it is painted. The first line of lettering consists of the caliber and type of round, such as "20MM (HEI)." On the next line (or next two lines if required) appears the lot number. The lot number is made up of a prefix (ZP, ZQ, etc), the serial number (assigned by calendar year), the loading plant's initials (assigned by Bureau of Naval Weapons) and the last two digits of the year of loading. On the last line appears the Mk and Mod of the round.

2-31. The color and marking that identify each type of round are as follows:

1. Dummy rounds have either brown projectiles and white lettering or blue projectiles and are identified by drilled holes 1 1/4-inches from the base.

2. HPT and LPT rounds have green projectiles or blue projectiles with brown noses. These rounds are also marked on the cartridge case with 1/4-inch black letters reading "High pressure (or low pressure) test round."

3. TP rounds have either green or blue projectiles with lettering in black or a blue projectile body with a brown nose. The lot number will have a "ZS" prefix.

4. HEI rounds have unpainted fuzes. The ogive portion of the projectile is yellow and the remainder of the body is red or the colors are reversed. Lettering is black and the lot prefix is "ZQ".

5. API rounds have no fuzes and the nose portion of the projectile is painted blue or brown with a red band. The body of the projectile is black and lettering is white with lot prefix "ZR".

6. AP T rounds have no fuzes and the nose portion of the projectile is painted yellow or brown. The body of the projectile is painted black and lettering is white with the lot prefix "ZT".

2-32. Assembled Rounds.

1. High Pressure Test Round Mk 101 Mod 0 and Low Pressure Test Round Mk 102 Mod 0. High pressure test (HPT) and low pressure test (LPT) rounds are used primarily for testing new production of guns. The projectiles contain no explosive charge. The Projectile Mk 11 Mod 0 of the HPT round is loaded with cast or powdered lead. The Projectile Mk 12 Mod 0 of the LPT round has no filler. Both types use Electric Primer Mk 47 Mod 0.

2. Dummy Round Mk 103 Mod 0. Dummy rounds contain no explosive charge in either the projectile or the cartridge case and are used for loading practice, belting practice, function testing of feed mechanisms, etc. The cartridge case for the Dummy Round Mk 103 is either manufactured for the purpose, in which case there is no primer cavity, or, for alternate assembly, cartridge cases rejected for service because of minor imperfections may have been used. These will have primer holes plugged with brass plugs or empty primer cups staked in place with three crimps equally spaced. In either assembly, the cartridge case is loaded with inert material to bring it up to standard weight and is crimped to a Projectile Mk 11 Mod 0 in the conventional manner.

3. Target Practice Round Mk 105 Mod 0. Target practice (TP) rounds have no explosive filler in the Projectile Mk 11 Mod 0. A dummy nose plug is used in place of a fuze.

4. High Explosive Incendiary Round Mk 106 Mods 0 and 1. High explosive incendiary (HEI) rounds have Projectiles Mk 12 Mod 0 which are loaded with tetryl and incendiary composition to give the combined effect of the blast of a high-explosive charge plus fire-starting ability. These projectiles are armed with instantaneous percussion fuzes of the impact type designated Mk 78 Mod 0 or 1.

5. Armor Piercing-Incendiary Round Mk 107 Mod 0. Armor piercing-incendiary (API) rounds have solid projectile bodies machined from steel. The ogive is sharply rounded to a short blunt nose. This shape increases the ability of the projectile to penetrate

armor instead of ricocheting. A steel adapter (false ogive) and an aluminum nosepiece containing an incendiary filler added to this projectile body give it the conventional length and contour. The incendiary charge is designed to ignite upon impact with the target to set fire to combustible materials (fuel, etc) and does not detonate. API projectiles have no fuzes or tracers. The projectile body with assembled nosepiece and adapter is designated Mk 13 Mod 0.

6. Armor Piercing-Tracer Round Mk 108 Mod 0. Armor piercing-tracer (AP T) rounds are similar to API rounds except that a cavity is machined in the back of the projectile body to receive a tracer mixture and instead of a false ogive and loaded nosepiece, a hollow windshield is used to bring the stubby projectile body up to standard length and contour. The windshield folds back when the projectile strikes the target and acts as a guide to prevent ricocheting off the target. AP T rounds do not have fuzes. The tracer charge is ignited by the heat of the propellant. The projectile body with assembled windshield is designated Mk 14 Mod 0.

7. 20MM Cartridge Case Mk 5 Mod 0, BuOrd Drawing No. 517534. The cartridge case is made of steel, zinc plated, and chromate treated. Its weight when empty is 0.25 pound. On the base are stamped the initials or symbol of the manufacturer, month and year of manufacture, and caliber and mark of case.

8. Propellant, Specification MIL-P-18942. Approximate weight of charge for service rounds is 650 grains. Exact weight is varied by loading depot as necessary to meet the ballistic requirement of the type of round.

9. Electric Primer Mk 47 Mod 0, BuOrd Drawing No. 583525. Primer weight is 22 grains. It consists of an open-ended brass cup containing a brass button. In contact with the other side of the button is the ignition charge consisting of a conductive explosive mixture. This is retained by a paper disc and a metal support cup. The whole assembly is press fitted into the primer chamber in the base of the cartridge case. In operation, electric current flows to the brass button by way of the firing pin. The only path for discharge of the current lies through the conductive mixture to the walls of the cup.

10. 20MM Projectile Mk 11 Mod 0, BuOrd Drawing No. 982323; Mk 12 Mod 0, BuOrd Drawing No. 982432; Mk 13 Mod 0, BuOrd Drawing No. 1350781; or Mk 14 Mod 0, BuOrd Drawing No. 1381197. The rotating band, which is a ring of gilding metal swaged into a circumferential groove near the rear of the projectile body, is stamped in 1/16-inch letters with the caliber, Mk and Mod of projectile, revision letter of drawing in effect at time of manufacture, and lot number. The code symbol (assigned by Bureau of Ordnance) is part of the lot number in all except AP rounds. In AP rounds, the code symbol appears first and the use of a lot number is optional.

11. Fuze, P.D., Mk 78 Mod 0, BuOrd Drawing No. 883614, or Mk 78 Mod 1, BuOrd Drawing No. 1236837 (for HEI round only). This is an instantaneous percussion fuze of the impact type which can penetrate light armor. It is issued assembled to High Explosive Incendiary Projectile Mk 12 Mod 0 used in Ammunition Mk 106 Mod 0 or 1.

WARNING

Fuzes shall not be disassembled. Any attempt to disassemble fuzes in the field is dangerous and is prohibited.

The detonator is contained in a rotor. A soft copper shear wire prevents the rotor from rotating the detonator into line with the firing pin until the round is fired. A close fitting windshield is crimped over the nose of the fuze to protect the firing pin. The material of which this windshield is made constitutes the major difference between Fuze Mk 78 Mod 0 and Fuze Mk 78 Mod 1. The Mod 0 has an aluminum windshield and the Mod 1 has a cadmium plated steel windshield. Fuzes are stamped in 1/16-inch letters with the Mk and Mod, contractor's initials or symbol, lot number, loading plant initials, and date of loading. This identification is located 1/8-inch above the body shoulder.

12. Tracer Mk 20 Mod 0, BuOrd Drawing No. 1252938 (for AP T round only). A tracer is installed in a cavity machined in the base of Projectile Mk 14 Mod 0 assembled in AP T Round Mk 108 Mod 0. The tracer body contains a pyrotechnic mixture designed to burn with a reddish color during the projectile flight. The tracer mixture is ignited by the heat or pressure of the propelling charge. The tracer is visible for approximately 1270 yards of projectile flight.

2-33. Handling and Safety Precautions. The ammunition should be handled with care at all times and the precautions set forth in OPNAV 34 P1 should be observed. The explosive elements in electric primers are highly sensitive to electrostatic charges and care should be exercised to prevent the primer button from coming in contact with static charges built up on the human body or other sources of electricity. All work tables, loading trays, and belting machines should be grounded.

WARNING

Fuzes shall not be disassembled. Any attempt to disassemble fuzes in the field is dangerous and is prohibited.

2-34. Fuzed ammunition (HEI rounds) should be handled in a manner to avoid denting or damaging the fuze cover. Dents or damage to the fuze cover may cause sterilization or nonfunctioning of the projectile upon impact with the target.

NOTE: Ammunition for the Mk 11 gun is packed in Small Arms Ammunition Box (Steel) Mk 1 Mod 0, BuOrd Drawing No. 439182. The moisture-resistant seal should not be broken until ammunition is to be belted. Rounds are packed in 16 rows of 14 rounds, a total of 224.

2-35. GENERAL FUNCTIONAL DESCRIPTION.

2-36. The following paragraphs describe the operation of the gun pod and its components and their interrelation to form subsystems within the gun pod.

NOTE: Right and left, clockwise and counterclockwise, upper and lower, and similar directional references apply to the gun pod with its assembled components as viewed from the rear with the gun pod in a horizontal position and attaching lugs at the top. The Mk 11 gun is mounted in the pod body with the four gun mechanism hangers in the up position. The gun mechanism, when removed from the pod body, is described in its bench position. The Mk 11 gun "bench position" is assumed when the four gun mechanism hangers are in the down position.

2-37. GUN POD. The gun pod is a complete self-contained gun system and has the following basic functions:

1. Houses 750 rounds of ammunition and mounts system components.

2. Readies the system for firing by charging a round into a firing position.

3. Feeds or transports the ammunition from the magazine to the Mk 11 gun.

4. Fires the ammunition at a 4000 shot per minute rate (or alternately at 700 shots per minute if selected).

5. Ejects spent cases and links, downward and rearward, at approximately 50 to 75 ft/sec.

6. Clears the Mk 11 gun of all live rounds for added safety when returning to base.

2-38. In addition to these basic functions, the gun pod controls blast and directs it away from the aircraft. All prime power is provided within the gun pod with the exception of a small amount of 400-cycle electrical energy (3.6 amps maximum for approximately one millisecond) to fire the primer in each round. Control circuit power is supplied from the aircraft 28-volt system (7 amps maximum).

2-39. MK 11 GUN. The Mk 11 gun achieves its high rate of fire because it fires two rounds concurrently and performs six operations simultaneously. While the two rounds are being fired, two are being rammed into chambers of the revolver cylinder and two spent cases are being ejected from the revolver cylinder into links. The ejection force decouples the link, and the case and link are ejected as a package. Figure 2-18 shows the six active stations of the revolver cylinder and the two-belt feed.

2-40. The upper barrel (when the Mk 11 gun is mounted in the gun pod) is called the first round barrel and fires the initial shot of the burst (see figure 2-4). The reaction of this shot causes the recoiling components to move rearward (breech assembly, revolver cylinder and barrels). The recoil energy is transformed into revolver cylinder rotational energy through a cam system engaging elliptical slots in the outer diameter of the revolver cylinder. This rotational energy is stored momentarily as in a flywheel and then is transmitted into counter recoil energy or into a forward velocity of the breech assembly (toward battery or the front of the Mk 11 gun) by the same cam mechanism. The revolver cylinder is indexed to the next chamber (45°) during this operation. The cam action and revolver cylinder indexing is shown pictorially in figure 2-19.

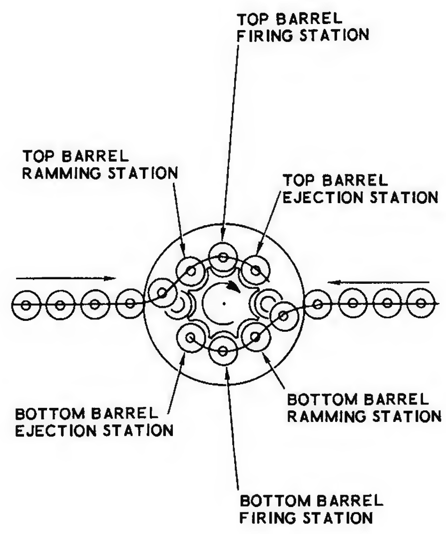


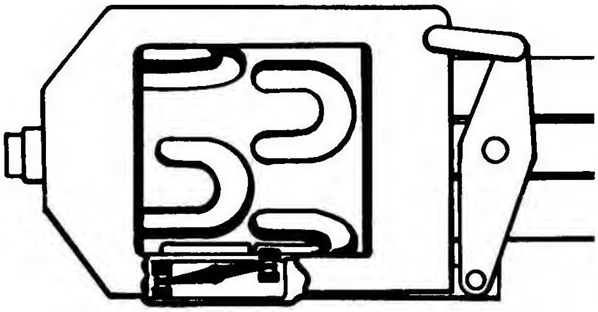
Figure 2-18. Revolver Cylinder Station Locations

2-41. The revolver cylinder is keyed to the cylinder shaft which rotates with the revolver cylinder. The cylinder shaft provides a spline coupling to the loader and rotates the eight-tooth loader sprocket. At each cycle, the loader sprocket advances one tooth and draws in one link and round from each side of the loader.

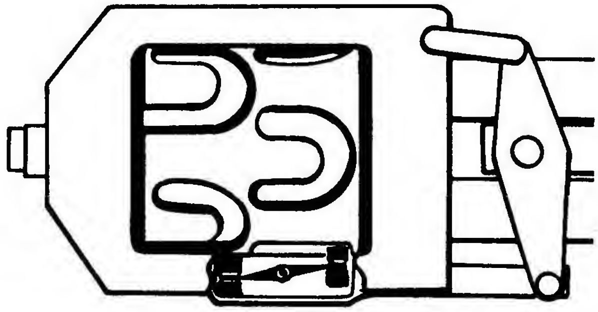
2-42. As the counter recoiling components return to battery, two rounds are fired and the Mk 11 gun again recycles. At each cycle two rounds are fired, two new rounds are drawn into the Mk 11 gun, and two cases are ejected. During a burst the Mk 11 gun cycles 2000 times per minute, firing two shots per cycle. The revolver cylinder rotates at an average speed of 250 rpm behind nonrotating barrels.

2-43. As the recoiling parts return to battery at the end of a burst, only the last round barrel fires. This stops the cyclic action and leaves an unfired round in the first round barrel, ready for the initiation of the next burst.

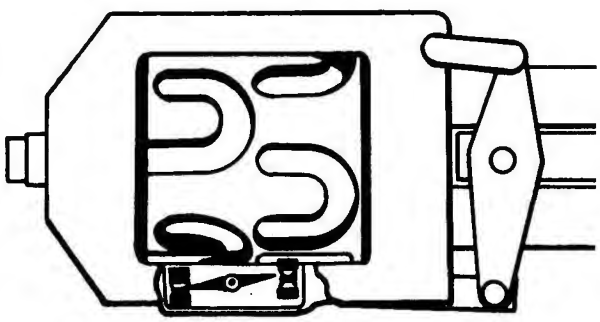
2-44. The above cycle is called the Marquardt cycle and provides a momentum exchange that reduces recoil loads. This exchange is described graphically in figure 2-20.



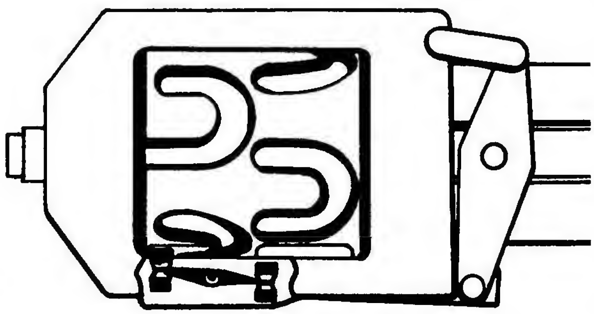
1. The recoiling parts are in battery position, with one of the two cam followers engaged with one of the eight U-shaped cams. The follower is at the end of one straight leg of the cam. From this position, the recoiling parts start moving to the rear.



2. The recoiling parts have reached full recoil position and the cam follower is at the center of the U-shaped cam. The near side of the revolver cylinder has turned downward 22-1/2 degrees. All of the translational energy has been converted to rotational energy, and the revolver cylinder is momentarily storing the energy like a flywheel. Note that the rocker swings upon its fixed center, and draws the cam followers forward as the revolver cylinder moves rearward. The followers slide in a longitudinal track in the breech.

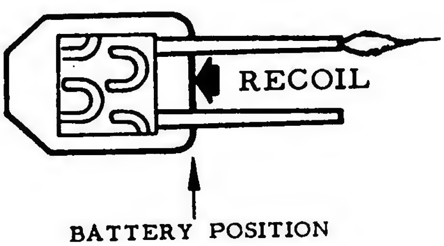


3. The recoiling parts are almost back into battery position. The revolver cylinder's energy has been given back to the sliding parts and now appears as energy of counter recoil. The revolver cylinder has been indexed 45 degrees and brought to rest again.

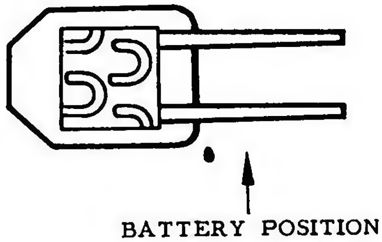


4. This drawing shows how the cam followers shift at the end of a cycle. The front follower has been withdrawn and the rear follower engaged with the next cam, keeping the revolver cylinder turning always in the same direction.

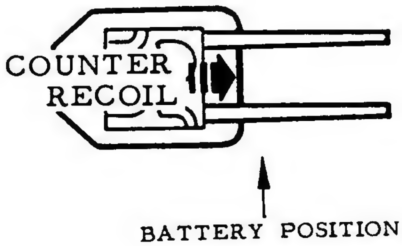
Figure 2-19. Camming Mechanism Operation



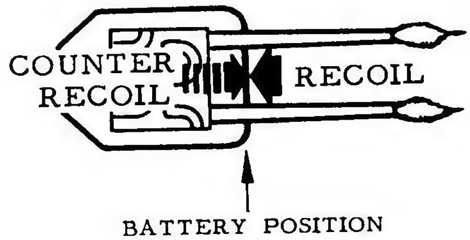
1. At the start of the initial cycle a single round is fired, and one unit of recoil momentum is developed in the recoiling parts.



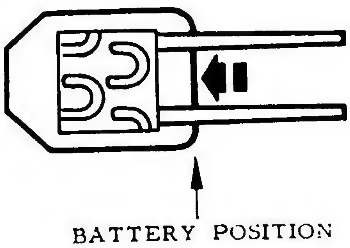
2. The recoiling parts are in full recoil position.



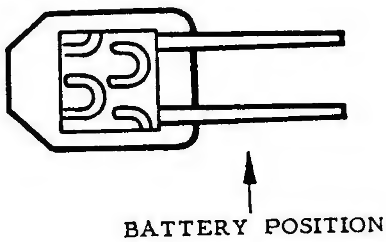
3. As the parts start to move forward again they pick up speed and when they approach battery position they have one unit of forward momentum.



4. As the counter recoiling parts near battery position at full undamped counter recoil velocity, two shots are fired simultaneously. This applies two units of rearward impulse to the sliding parts. Since the parts at this time have one unit of forward momentum, there is a momentum cancellation effect.

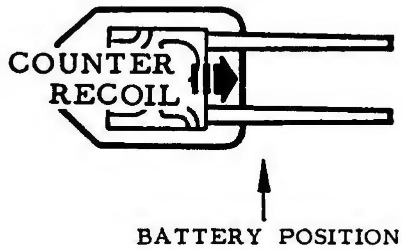


5. The steady-state cycle begins. After the momentum cancellation, the sliding parts again have one unit of recoil momentum, since the one unit of counter recoil momentum cancelled one of the two units of recoil impulse, leaving only one unit in a rearward direction. The momentum condition that exists at the start of this steady-state cycle is therefore exactly the same as the condition that exists at the start of the initial cycle.

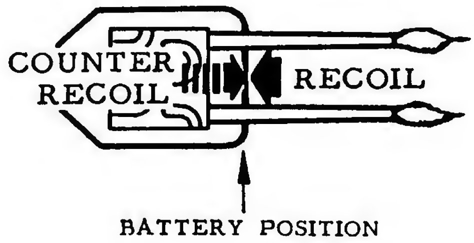


6. The recoiling parts are again in full recoil position.

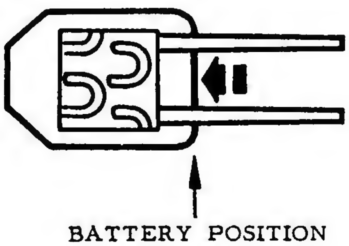
Figure 2-20. Momentum Cancellation (Sheet 1 of 2)



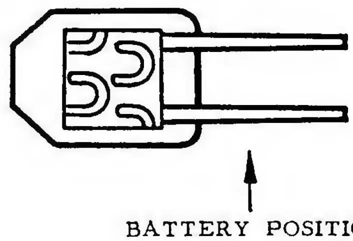
7. Here there is one unit of counter recoil momentum, exactly as there was in the initial cycle.



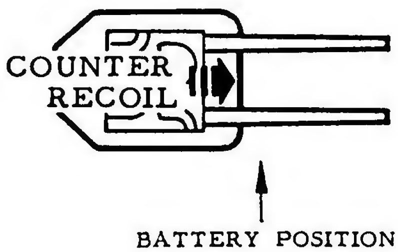
8. At the end of each steady-state cycle a cancellation effect occurs, identical to to the cancellation effect at the end of the initial cycle.



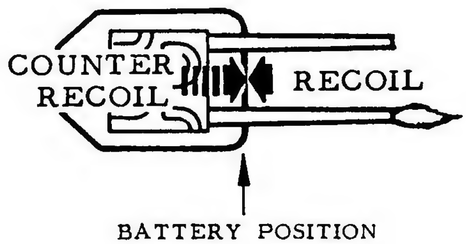
9. This final cycle in a burst looks like any other cycle at its start.



10. The recoiling parts are in full recoil position again.



11. There is one unit of counter recoil momentum, exactly as in the initial cycle steady-state cycle.



12. At the end of the final cycle, only one shot is fired. The impulse of this one shot exactly cancels the counter recoil momentum of the parts, and they are brought to a halt in battery.

Figure 2-20. Momentum Cancellation (Sheet 2 of 2)

2-45. The firing sequence between the two barrels is controlled by the gun pod electrical system (relays in the control box). Timing of the firing relative to recoil position during each cycle is provided by contacts within the gun mechanism. When the slow rate is selected, the firing rate is reduced by introducing electrical time delays into the firing circuit (see paragraphs 2-89 through 2-96 for firing circuit details and function).

2-46. Gun Mechanism. Since the gun mechanism incorporates the basic frame of the Mk 11 gun (receiver), all the recoiling parts, and the components that contain the high pressures during cartridge firing, it contributes greatly to the overall gun function described above. In addition, some functions are primarily provided within the gun mechanism itself. For example, the gun mechanism receives the rammed round, positions the round for firing, extracts the case from the chamber after firing, imparts ejection velocity to the case after extraction and provides recoil boost to control gun speed. The gun mechanism also incorporates the means for cycling with air by providing a valve, an actuating cylinder, and passages for air ejection.

2-47. As the round is rammed into the revolver cylinder, it depresses the anti-bounce latch in the round positioner (see figure 2-4). The round positioner is located between the revolver cylinder and the breech at the aft end of the revolver cylinder. The latch prevents the round from rebounding as it seats in the chamber. Ramming starts when the Mk 11 gun is approximately at full recoil and is completed by the time the breech returns to battery. As the Mk 11 gun proceeds with the next cycle, the rammed round is rotated into firing position. The round is drawn back by cams on the round positioner to provide the proper headspace relative to the anvil located on the aft portion of the breech. As the round rotates into position, it depresses a spring-loaded firing pin within the anvil. The firing pin has a hard coating and is sharp enough to cut through varnish or waterproofing finishes on the primer.

2-48. Firing voltage (400-cycle AC) is supplied through the firing pin. Firing timing is provided by contacts on the firing pin holder and the gun junction box. The firing pin holder is located just aft of the anvils and is latched to and recoils with the breech. The gun junction box is stationary and is mounted to the receiver. Contact is made 1/8 inch from battery as the breech moves forward. Separate contacts are provided for the first and last round barrels.

2-49. Ring seals are provided at each chamber at the forward surface of the revolver cylinder. These seals move forward from gas pressure during firing and form a seal between the barrel insert and the revolver. The barrel insert is removable so as not to limit barrel life by rear face condition or the high erosion that occurs near the breech. A schematic cross section of this area is shown in figure 2-21.

2-50. The Mk 11 gun uses a smooth bore barrel which in turn permits a smooth bore insert that is not indexed. To provide projectile stability, the projectile is spun in the revolver by a rifled insert approximately 2 inches long with a 26-degree rifling angle. The rifled insert is held in place by the ring seal seat. In the two inches of travel, the projectile is accelerated linearly to 900 ft/second and rotationally to 130,000 rpm. The rotating band is reformed in the smooth bore insert and the projectile emerges from the barrel at 3300 ft/second and 115,000 rpm. The configuration is shown in figure 2-22.

2-51. After the round is fired, revolver cylinder rotation moves the spent case toward the eject station. As the case advances to this position, the extraction lip engages the extractor in the round positioner and a cam in the auxiliary extractor, which is located at the outer periphery of the revolver cylinder, and the case is loosened from the chamber. At the completion of the cycle the case to be ejected is positioned by a detent in the round positioner. It is so held until gas or air is introduced at the front of the eject chamber.

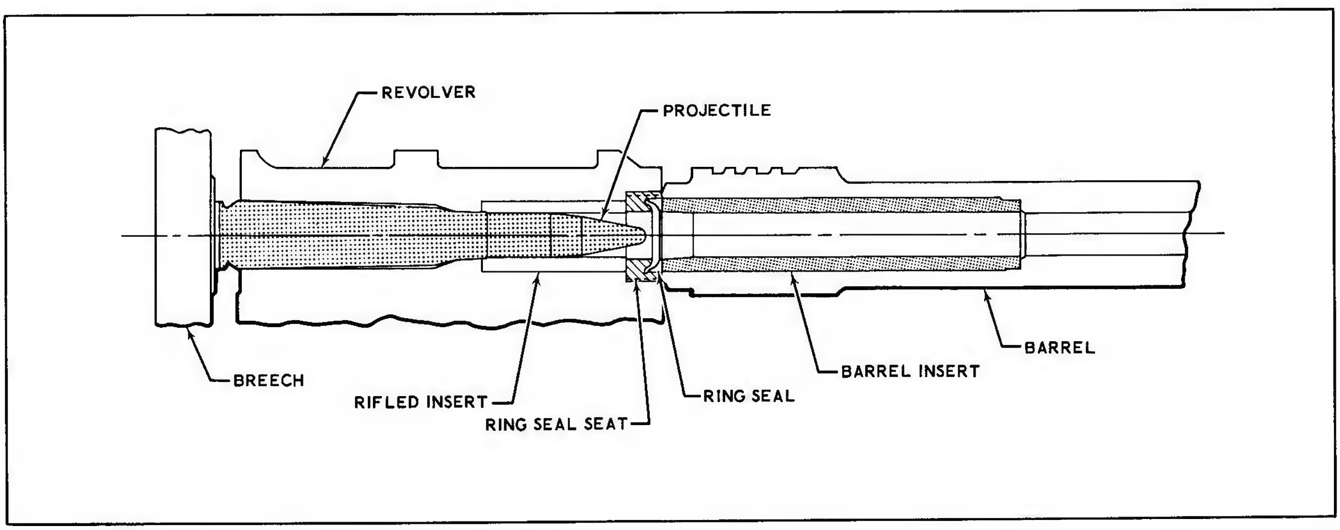


Figure 2-21. Breech, Revolver and Barrel Schematic Cross Section

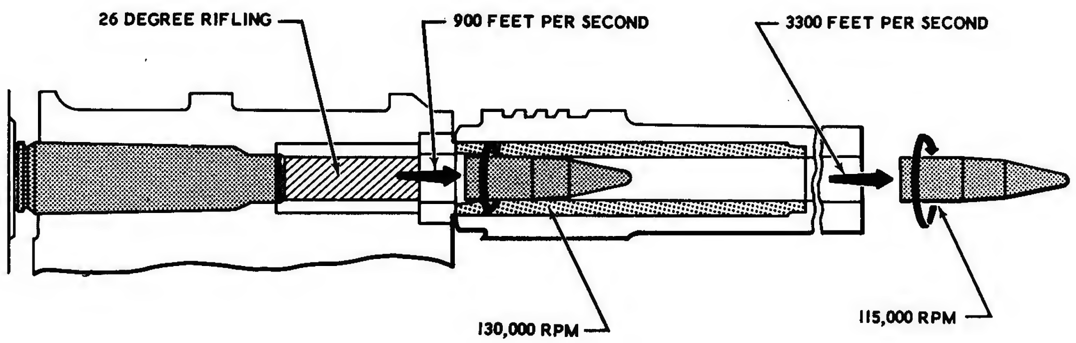


Figure 2-22. Projectile Rotation and Linear Speeds

2-52. Should a malfunction occur and the case fail to eject, the case will strike a lug on the round positioner and prevent further revolver cylinder rotation which in turn will prevent a double feed.

2-53. Ejection gas is routed from the booster block which in turn receives its gas from a barrel port during firing or from the pneumatic supply during charging.

2-54. The booster block provides two gas-actuation type chambers around the two gun barrels: one encases the first round barrel which is pressurized by gun gas; the other encases the last round barrel which is pressurized with air. Both chambers operate in a similar way, in that the pressure acts on a flange on the barrel to provide a rearward force on the recoiling parts. The chamber encasing the last round barrel is pressurized only during charging. The chamber encasing the first round barrel is pressurized during each gun cycle by ports from the barrel bore to boost recoil speed.

2-55. Some gas is diverted from the booster to the ejection station by tubes. The ejection tubes from the air chamber join those from the gas chamber in a Y connection just forward of each ejection station. The shape of this Y is designed to minimize losses as only one tube is pressurized at a time (either gun gas or air).

2-56. A portion of the gas from the first fire booster chamber (gun gas) is routed through a transport tube along the right side of the Mk 11 gun to supply the rams in the loader. During charging, the rammer system is supplied by a separately controlled source (refer to paragraph 2-64).

2-57. The gun sequence switch is held in place by a quick latch mechanism on the left rail of the receiver. It is coupled to a stud on the breech and is actuated by breech recoil. It provides signals for charging and firing the last round barrel (refer to paragraphs 2-89 through 2-96 for electrical operation details). One set of contacts is normally closed when the Mk 11 gun is in battery. The switch is set so that these contacts open after 0.125 inches of recoil. The length of the switch arm is adjustable to provide for switch timing.

2-58. The recoil loads are transmitted to the receiver through the damper assembly. The damper also provides energy absorption should the counter recoiling parts move forward of battery. (The breech will move forward of battery if both rounds fail to fire during a burst or if a burst terminates with a two round firing.)

2-59. The hold-forward spring is located between the receiver rails and positions the breech assembly at battery when the gun is at rest. The spring is not a recoil spring as such, but is compressed during recoil and adds to counter recoil velocity.

2-60. Loader. The primary functions of the loader are to draw the two ammunition belts into the Mk 11 gun, ram the rounds out of the links and into the revolver cylinder chambers, and guide the spent cases or unfired rounds from the ejection chamber back into the link for ejection of the link-case package.

2-61. The belted ammunition is drawn into the loader by the loader sprockets (see figure 2-6). Guides in the feed chutes align with the rails of the loader so that the loop of the link indexes on the rails. The slot in the loop engages the rails (top and bottom of link) and positions the link in the fore and aft direction within the loader. As the Mk 11 gun cycles, the round and link advance to a position in front of the rammer with the cut-out section of the link-carrier toward the rammer. This cut-out provides clearance for the ram as it engages the round and propels it forward.

2-62. At the two diametrically opposite ramming stations, gas operated rammers simultaneously ram two rounds forward out of their links into two empty chambers of the revolver cylinder. Energy for ramming during firing is obtained from a pulse of gun gas (at approximately 1500 to 2000 psi) delivered by the gas transport tube of the gun mechanism from the booster block. The gas is routed through the loader

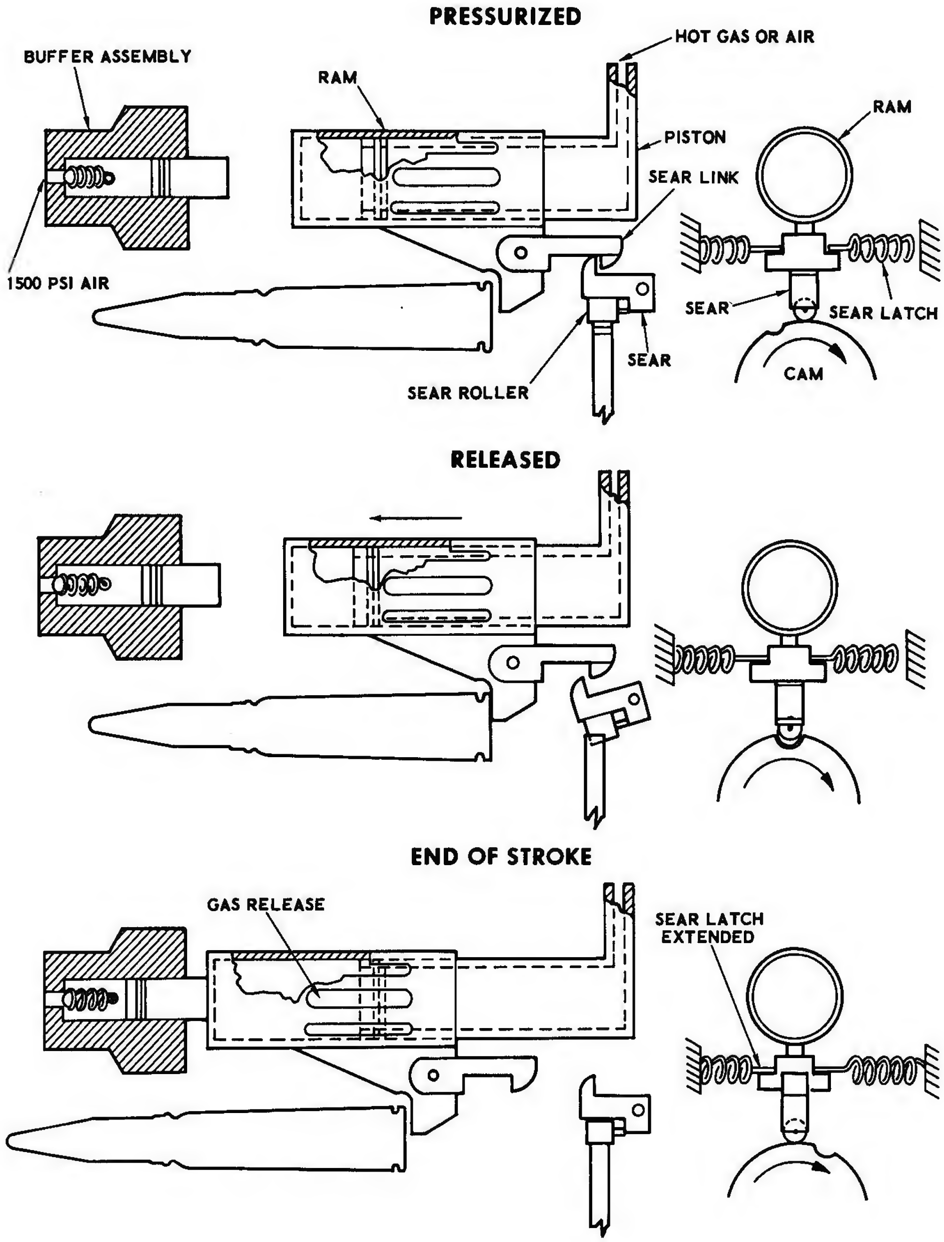


Figure 2-23. Searing and Ramming Action (Sheet 1 of 2)

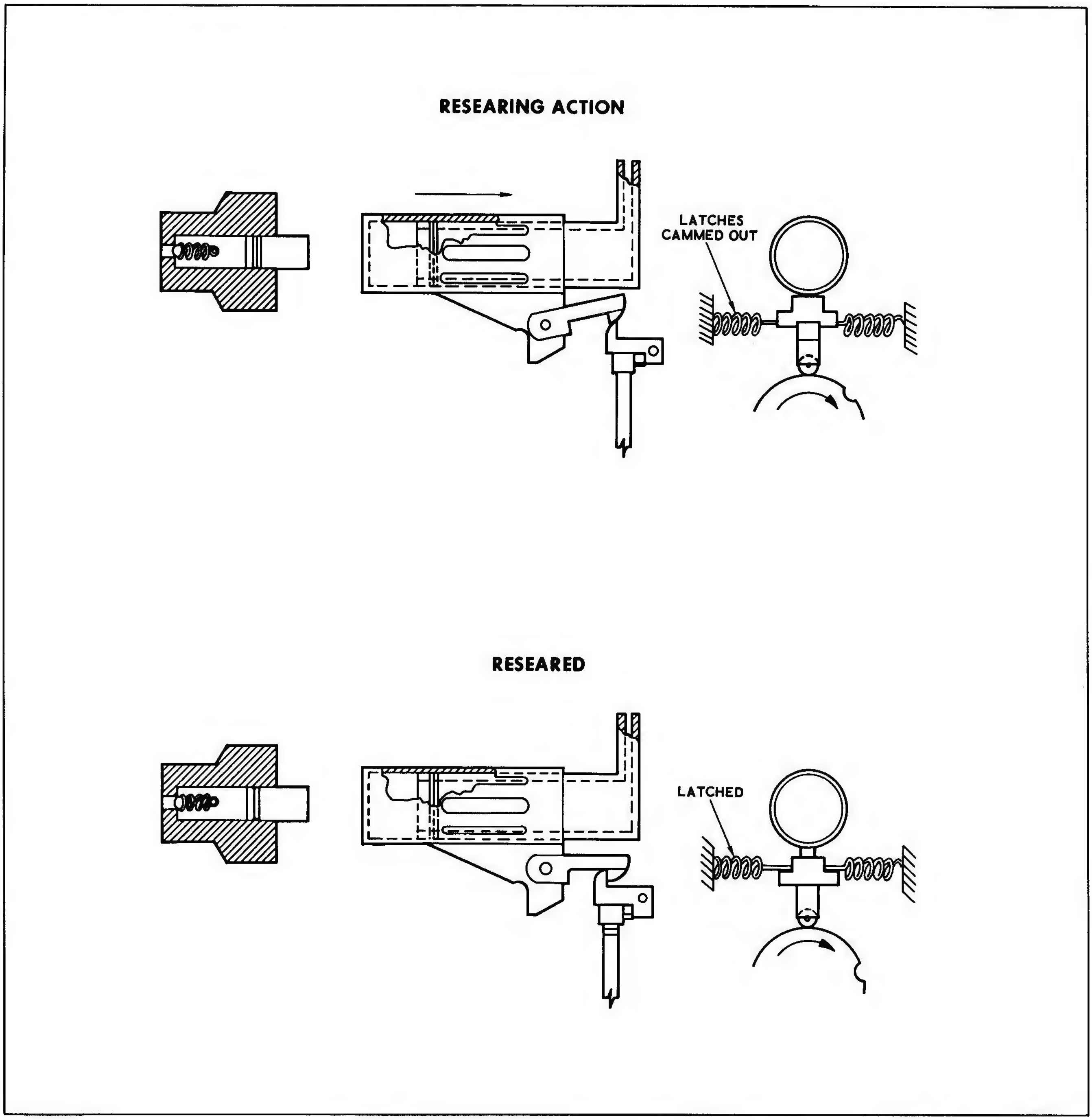


Figure 2-23. Searing and Ramming Action (Sheet 2 of 2)

gas tube, to the manifold, and then to the two hollow and stationary pistons of the rammers. A hot gas check valve is located in the manifold at the junction to the loader gas tube. The gas is stored by check valve action in the manifold, pistons, and ram cavity until the ram is released by sear action. By the time the ram is released the gas pressure behind the ram has dropped to approximately 1000 psi. This is sufficient force to provide a ram velocity of approximately 50 ft/second.

2-63. The cam, which is a part of the sprocket cluster assembly, rotates with the sprocket and the revolver cylinder. At the proper degree of rotation the cam releases the sear and the ram moves forward and impacts the round. At approximately mid stroke of the ram the ports advance in front of the piston and the gas begins to be released. At the end of the stroke the ram strikes an air buffer and rebounds towards the seared or rear position. By this time most of the gas has escaped from behind the ram and the stored energy in the rebounding ram cycles it back to the researed position. Figure 2-23 shows the searing and ramming action. Spring side latches prevent the sear link from bouncing out of engagement after researing.

2-64. During charging, ram function is identical except that the gas is provided by the pneumatic supply and is metered by a two-way solenoid operated valve mounted on the manifold. Between the valve and the manifold is a heat barrier check valve to prevent hot gun gas from entering and impinging on the valve seats. A seal is provided around the check valve by a dimpled metal gasket.

2-65. After the rounds are rammed from the link, the link remains in the loader sprocket. As the sprocket rotates, the link is advanced behind the breech to the ejection station. The link cams the oscillating guide into position, which in turn provides a funnel for guiding the ejected case into the link. The link is decoupled from the belt at this station.

2-66. The second valve at the back of the loader controls air flow to the declutch piston located in the center of the back plate. It is a three-way valve that pressurizes the piston which in turn disengages the sprocket from driving spline and locks it to the back plate. At a halfway position, the sprocket is free to rotate as the clutch has disengaged from the driving spline, but has not coupled with the stationary lugs of the back plate. This position can be reached by pressurizing the piston, turning the nut at the piston center to engage the lugs of shaft and releasing the air. Freeing the sprocket aids in unloading the Mk 11 gun. The clutch is normally held in engagement by an internal helical spring.

2-67. POD ASSEMBLY. The pod assembly includes the pod nose, pod tail, pod body and subsystems that physically and functionally support the Mk 11 gun. The primary purpose of the pod body structure is to house components under aircraft and gun firing environment. The pod body structure also provides a means for easy access to components for servicing and maintenance. The pod tail and pod nose may be removed from the pod body for maintenance or to provide a shorter overall package size for shipboard handling. The barrels can also be removed for this purpose.

2-68. The pod assembly provides a streamlined container designed for high speed flight and for high catapult and arresting loads. The gun pod can be flown and fired at speeds up to Mach 1.2 at 10,000 feet altitube and Mach 2.2 at 60,000 feet. The gun pod can tolerate vertical accelerations of 10 G and side accelerations of 6-1/2 G. It can withstand catapult and arresting loads of 9 G. The Mk 11 gun may be fired with acceleration loads up to 6 G on the pod assembly.

2-69. Two removable quick-release main doors provide access for loading the magazine and servicing the Mk 11 gun. Two small inspection doors and two inspection windows provide for checking the magazine while it is being loaded. A service door in the pod tail provides access to the pneumatic reservoir. The pod nose is removed for access to the forward end of the Mk 11 gun or for removing the Mk 11 gun. The pod tail is also removed by the same type of quick-release latches.

2-70. Ammunition Magazine. The ammunition magazine (see figures 2-7 and 2-24) is designed to store 750 rounds of belted ammunition. The ammunition in the magazine is controlled under all G-load conditions. Each cartridge has a place and it cannot move from that place until it is withdrawn by the feed system. The magazine is designed so that only a short loop of each belt, rather than the entire mass of ammunition in the magazine, is accelerated when the gun starts firing. As the Mk 11 gun starts firing, the belts begin to withdraw, automatically continuing from each of the next succeeding compartments in a smooth, continuous operation. The magazine always remains in balance as the belts are being withdrawn. While they are being withdrawn, the magazine is slowly rotated by a power drive from the feed system gear box to the ring gear. The gear box drives the magazine at very low speed through a worm gear reduction, and the speed of rotation is synchronized with the rate of belt withdrawal so the proper compartment of the magazine is always in line with the feed throat. The magazine rotates one-half turn from full to empty.

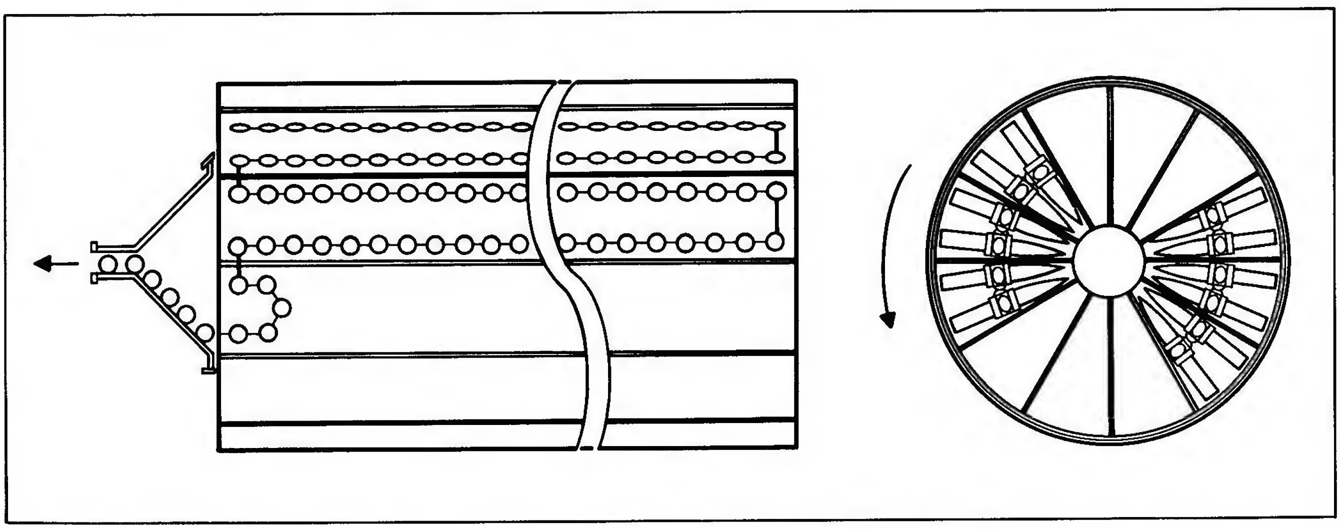


Figure 2-24. Ammunition Magazine Functional Diagram

2-71. The two belts that feed the Mk 11 gun are loaded into the magazine symmetrically about its longitudinal axis so that the two compartments from which belts are being withdrawn at any time are diametrically opposite each other. The magazine can be partially loaded if desired. The magazine is loaded by reversing the flow of ammunition through the feed system. Auxiliary loading chutes, which lead in through the main access doors, are attached in place of the feed chutes that lead to the Mk 11 gun. The belts are fed into the magazine, through the loading chutes, by the feed system sprockets, to which hand cranks are engaged for this operation. At the conclusion of the loading operation, which takes about 10 minutes, the belts are cranked forward from the magazine through the feed system and into the loader until the leading links are firmly against the loader sprocket.

2-72. Feed System. An understanding of the functioning of the feed system can be obtained from figure 2-25, which schematically diagrams the movement of the ammunition belts from the magazine to the loader. When firing begins, the solenoid valve on the pneumatic motor is energized and the motor then begins to drive the gear box which transmits power to the feed sprockets by means of the sprocket shaft. As the sprockets rotate, they pull the ammunition from the magazine and drive it through the feed chutes to the loader. The pneumatic motor is energized when either the charge or firing circuit is closed.

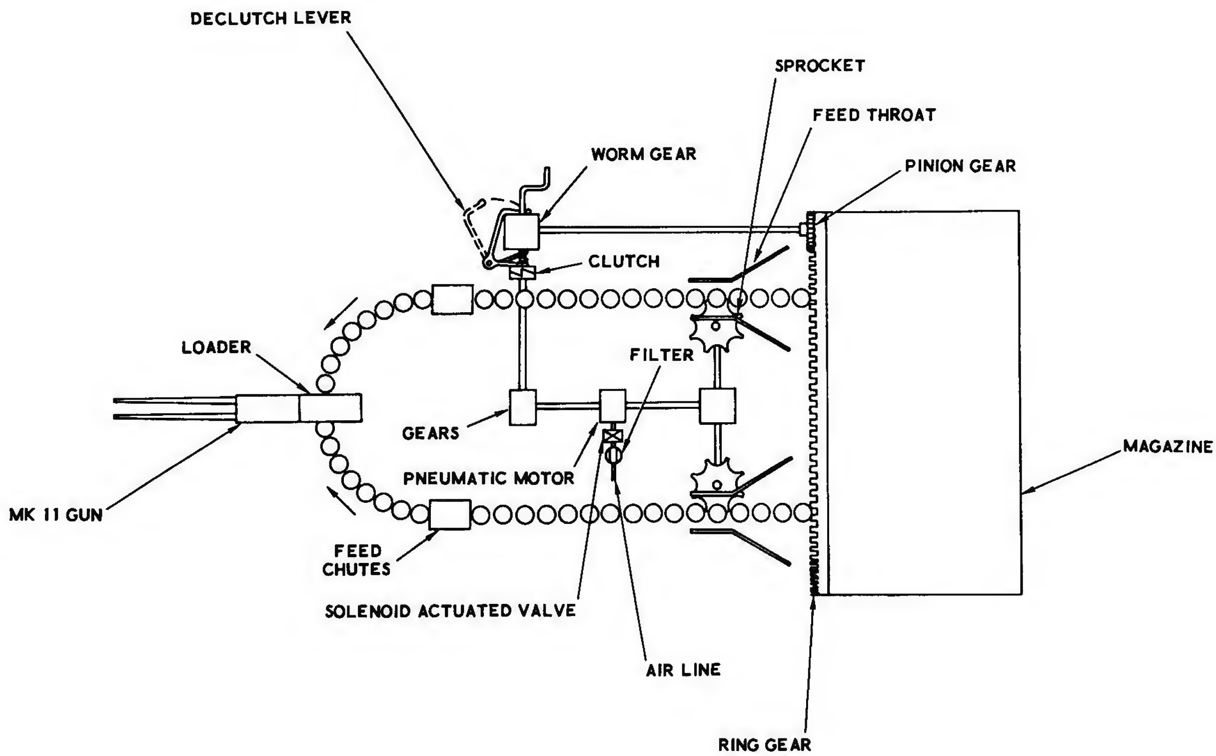


Figure 2-25. Feed System Diagram

2-73. Pneumatic System. The pneumatic system (see figure 2-26) provides the energy that drives the feed system and magazine, and charges the Mk 11 gun. It also provides the air for the rammer buffers and the clearing clutch.

2-74. The pneumatic system is self-contained and is completely independent of the aircraft. It has a reservoir that is charged to 3200 ± 200 psi when the gun pod is being serviced on the ground. The spherical, high pressure reservoir is serviced through the tail section. Compressed air travels from the high pressure reservoir to the Mk 11 gun compartment through a 3/8-inch OD line. The hand-operated cutoff valve is closed except when the gun pod is prepared for takeoff of the aircraft. This valve minimizes leakage by isolating the high pressure reservoir from the downstream end of the system. The 3200 ± 200 psi air is reduced to 1500 psi at the regulator and stored in a small accumulator immediately adjacent to the air-consuming devices. The accumulator is necessary to supply the high flow needed during charging. A 5/8-inch OD line runs to the large solenoid valve (charger valve) on the gun mechanism, and 1/4-inch OD lines run to the loader and pneumatic motor. A manually operated dump valve allows the Mk 11 gun and loader to be depressurized for removal without emptying the main reservoir. The cutoff and dump valves are mechanically coupled and interlocked with the left main access door to insure correct positioning prior to flight. Pneumatic quick-disconnects are provided on the Mk 11 gun and loader so that removal does not require tools. The disconnects are locked in place by line pressure and cannot be removed until the pressure has been removed.

2-75. Electrical System. A schematic diagram of the electrical system is shown in figure 2-31 and a general location layout of electrical components is shown in figure 2-9. Typical aircraft cockpit controls consist

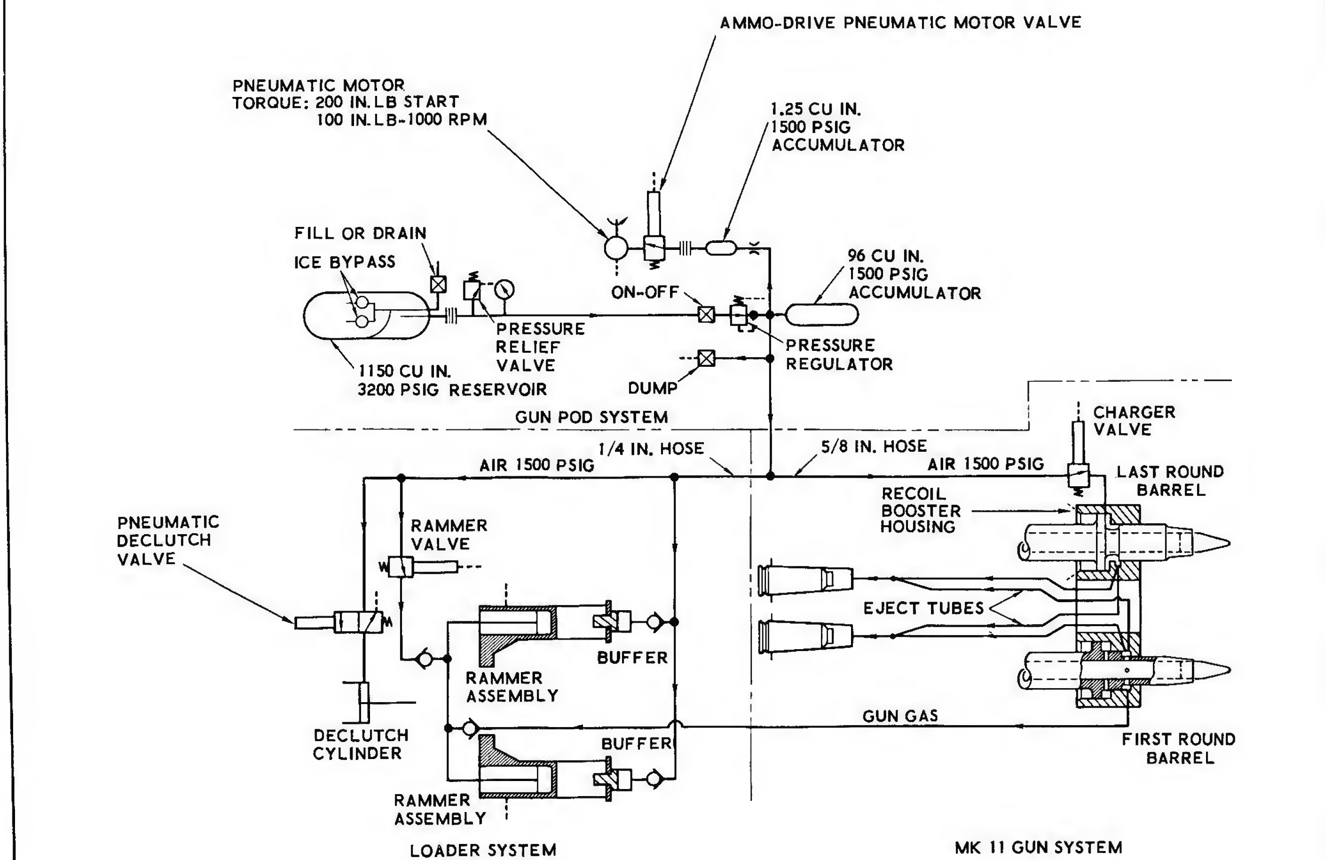


Figure 2-26. Pneumatic System Operational Diagram

of a trigger, a master armament switch, and a ready/clear switch. The cockpit controls are connected to the gun pod at a receptacle in the top of the gun pod through a cable and a single plug within the fairing of the external stores rack pylon. A lanyard is connected to the aircraft-to-gun pod quick-disconnect plug for jettison release. The aircraft electrical system provides 28-volt dc signals to control the operations of the gun pod and 120-volt 400-cycle ac pulses for firing the ammunition. The Mk 11 gun itself is self-powered.

2-76. The primary component of the electrical system is the control box. This control box controls the firing, charging, and clearing functions of the Mk 11 gun. During firing, the control box sequences the firing of one barrel at the beginning and the other barrel at the end of a burst and the firing of both barrels simultaneously on all other cycles. It controls charging of the Mk 11 gun by sending signals at the proper time to the solenoid valves that charge the Mk 11 gun. The box automatically initiates a charge cycle when it senses a misfire round. The automatic charging feature may be cut off, if desired. The control box will also automatically clear the Mk 11 gun when the pilot activates the clear switch. When the slow rate of fire is set at the gun pod junction box, the control box will regulate the rate of fire at 700 ± 100 rounds per minute. Detail information describing electrical component function is provided in paragraphs 2-89 through 2-96.

2-77. Cook-off Control, Blast Control, and Cooling Systems. During firing, the blast suppressor catches the high pressure muzzle gases of 5000 psi in the plenum chambers and exhausts it away from the aircraft at approximately 1000 psi (see figure 2-27). The suppressor is divided into 2 chambers, providing a separate chamber for each barrel and preventing the last fire barrel from pressuring the first and activating the gas eject system when the last round is fired. The suppressor is designed to minimize vibration and to prevent skin damage to the aircraft during gun firing by reducing blast and preventing contaminants from striking the aircraft. The stopping of forward flowing gun gas reduces trunnion reaction as would a muzzle brake, and the torque created by the downward flow tends to cancel recoil torque about the gun pod lugs. The support of the barrels in the diffuser aids accuracy. Inserts at the forward section absorb blast damage caused by unburned powder, other residue, and corrosive gases. These inserts are replaceable.

2-78. During the periods between bursts, the blast suppressor acts as an inlet for cooling air and a pressure reducer at the gun muzzle (see figure 2-28). These two functions control cook-off by providing gun cooling and preventing air, heated by the barrels, from flowing down the barrels and impinging on the projectile. The aerodynamic fence at the forward side of suppressor acts as a gate in front of holes provided for the projectiles. The air flow is separated by the fence and no air enters the plenum chambers or is directed toward the muzzles. The blocking of this flow together with the pressure drop associated with the louvers at the plenum outlets reduces plenum pressure or the pressure at the barrel muzzle. The reverse louvers at the main access doors tend to increase the pressure at the aft or breech end of the barrel. The result is that flow in the barrel is away from the breech and the round in the chamber.

2-79. The two inlets at the blast suppressor route cooling air through a duct system to the two unused

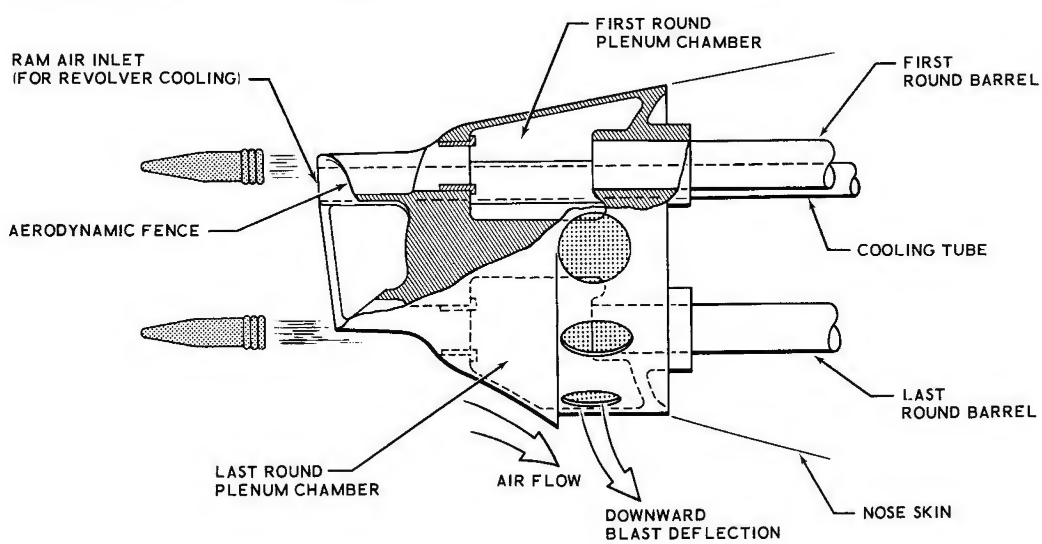


Figure 2-27. Blast Control

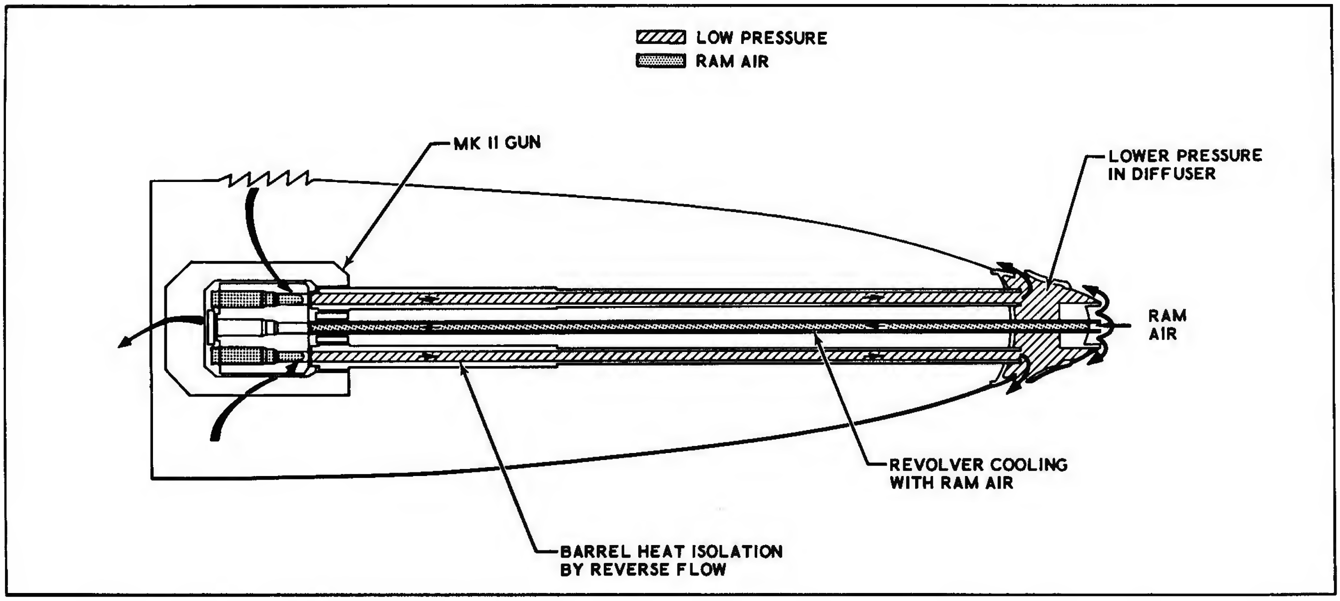


Figure 2-28. Cook-Off Control and Cooling

chambers in the revolver. This cooling air keeps the revolver temperature below that required to produce a cook-off. The cook-off control and cooling systems are shown schematically in figure 2-28.

2-80. The louvers incorporated in the main access doors of the center ejection are also designed for gun gas control within the pod. Built to area and configuration requirements, the louvers relieve gas pressures as well as allow the gun gas to ignite at random and burn safely within the gun pod. The gun pod is not damaged by transient flame.

2-81. BORESIGHTING. The pod is boresighted by aiming the pod rather than the gun. This is accomplished by extending or retracting the forward lug for elevation, and sliding the rear lug in its ways for azimuth adjustment. The forward lug is extended by rotating the collar (see figure 2-29) inside the pod directly beneath the lug. The collar is normally turned by hand but a 1/2-inch square hole is provided for a breakdown handle should more leverage be required. The collar is detented in 1/8-turn increments which correspond to approximately 1/4 mil of elevation or depression for the forward 30-inch lug and 1/2 mil for the forward 14-inch lug. Direct reading of lug setting can be read in 5 mil increments from the theoretical nominal setting (0°) as inscribed on the side of the lug. The aft lug is adjusted by turning an internal screw within the lug. The screw is adjusted by a 5/32 inch Allen wrench inserted through the slot in the base end (see figure 2-30). The screw is detented and does not require locking. Azimuth readings can be read in 5 mil increments at the top of the pod. (See figures 3-3 and 3-4 for lug adjustment details.)

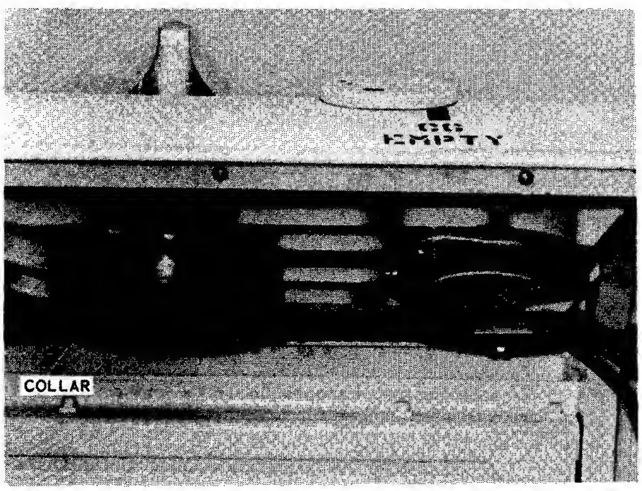


Figure 2-29. Forward Lug Collar

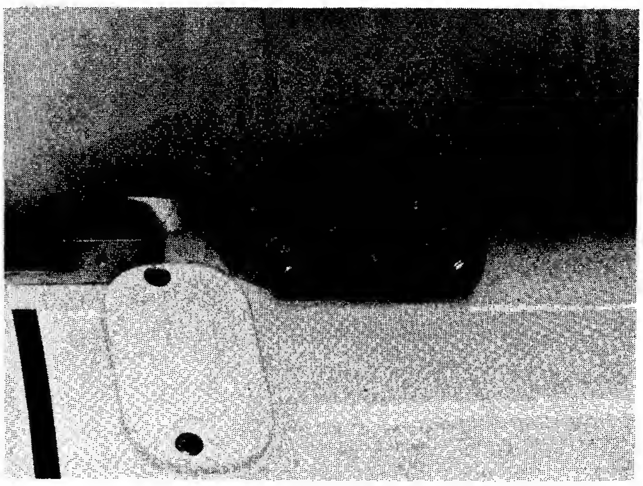


Figure 2-30. Aft Lug Base End

2-82. Boresighting of a pod can be preset by correctly prelocating the lugs relative to their respective index marks for the particular installation and then installing the pod. This approach requires that the racks be properly located and aligned. However as racks wear and are interchanged, the accuracy of rack alignment is not known. The aim accuracy can be cross-checked by boresighting in a standard way with a boresight tool inserted in the muzzle of the Mk 11 gun and the pod adjusted to the boresight card. The detail procedure will vary from aircraft to aircraft. However, once a lug setting is established for a particular installation, the pods can be interchanged by interchanging lug settings, since barrel to lug alignment is closely held within pods.

2-83. Mk 11 Gun Cycling and Charging. The Mk 11 gun may be cycled without firing. Air in the pneumatic system operates a cylinder (around the last round barrel) that drives the Mk 11 gun into recoil, indexing the revolver cylinder. Simultaneously, air ejects the cases from the two chambers at the ejection stations and operates the two rammers. This entire charging operation is initiated by an automatic circuit in the control box whenever the Mk 11 gun remains in the battery position longer than 80 milliseconds and the trigger is depressed, as would be the case if a dud round were encountered. Charging is extremely fast, taking less than two-tenths of a second to sense the problem and complete the charge cycle. At the completion of the automatic charge cycle, the Mk 11 gun does not have to be brought to a halt in battery and started again with a single shot. The counter recoil velocity at the end of a charge cycle is the same as that at the end of a firing cycle, so the Mk 11 gun can fire two shots on the fly, just as in a regular firing cycle, which allows the Mk 11 gun to be back into action fast.

2-84. Manual charging can be accomplished by actuating a switch in the cockpit. In this case only one charge cycle occurs until the switch is reenergized.

2-85. Recoil Loads. Loads at the attaching lugs are approximately 8000 pounds (maximum peak) in recoil and approximately 5000 pounds (peak) in counter recoil. The recoil booster produces the forward load at the start of each cycle. The average force of the gun pod is approximately 2500 pounds which is less than would be anticipated from the projectile impulse because of the muzzle brake effect of the blast suppressor. Forward and aft loads are reacted at the forward lug and vertical loads are distributed between the two lugs.

2-86. DETAILED CIRCUIT ANALYSIS.

2-87. ELECTRICAL CIRCUIT. The gun pod and gun mechanism electrical system consists of five major circuits; charging, firing, automatic charging and dud sensing, slow firing rate, and gun clearing.

CAUTION

The gun pod and Mk 11 gun will function only with negative grounded dc power.

2-88. CHARGING CIRCUIT. Closing the ready switch in the aircraft energizes relay K3 (see figure 2-31) through the sequencing switch on the Mk 11 gun. Relay K3 actuates the charger and rammer solenoid valves, which admit compressed air into the charging and ramming cylinders on the gun mechanism and loader. This cycles the gun mechanism and loader in the same manner as a firing cycle. As the Mk 11 gun charges, two rounds that were in ram positions are brought into firing position, and two more rounds are rammed. The charger valve also feeds air into the two ejection chambers and ejects any cases or cartridges that are there. During recoil of the Mk 11 gun, normally-closed contacts in the sequencing switch on the gun mechanism open. This interrupts the power to the charger and rammer solenoid valves, allowing the valves to close. Also, when the Mk 11 gun recoils, normally-open contacts in the sequencing switch close and energize relay K4, which in turn energizes relay K5. Relay K5 has an electrical interlock circuit which holds it closed as long as the ready switch is in ready position. The closing of relay K5 accomplishes two functions: First, it opens the circuit to the rammer and charger valves and prevents the charge cycle from repeating when the gun mechanism returns to battery position; second, it transfers the pneumatic motor solenoid from the charging circuit over to the firing circuit. Thus the pneumatic motor booster runs for a short time only during the charge cycle, but is made ready to run again when the trigger is actuated.

2-89. FIRING CIRCUIT. After closing the master armament and ready switches in the aircraft, pressing the trigger energizes relay K1 in the control box, which feeds firing voltage (approximately 210 volts ac rms) from transformer T1 to the first-round barrel only. When this barrel fires, the gun mechanism recoils and relay K4 is actuated by the sequencing switch on the gun mechanism. Relay K4 in turn closes relay K2. Relay K2 feeds firing voltage from transformer T2 into the last round barrel. With both K1 and K2 relays closed, both barrels will fire simultaneously in succeeding cycles as long as the trigger is pressed.

2-90. Relay K2 and its circuit provides a delayed opening time which maintains circuit continuity for approximately 0.085 seconds after the sequencing switch opens the coil current as the gun returns to battery position. After the trigger is released, relay K1 opens immediately, but relay K2 remains closed long enough (approximately 0.085 second) to fire the last round barrel only and stop the Mk 11 gun.

2-91. Even though the firing relays K1 and K2 remain closed during the entire gun cycle and the primers in the rounds are in contact with the firing pins during a large part of the counter recoil portion of the cycle, firing does not occur until the firing switch on the gun mechanism closes as the recoiling parts approach battery. This switch consists of two pairs of contacts; one on the gun junction box and one on the firing pin holder.

2-92. AUTOMATIC CHARGING AND DUD SENSING CIRCUIT. If the Mk 11 gun does not fire when the trigger circuit is energized, such as might occur if a dud round was encountered during a burst, the Mk 11 gun will hesitate. After a delay of approximately 0.08 second, the Mk 11 gun will automatically charge and commence firing immediately. This action is provided by a jumper (on TB301 between pins 7 and 8) in the pod junction box between the trigger circuit and regular charge circuit. The charge circuit is energized thereby at the same time the trigger is pressed. Because relay K3 has a slow pull-in time delay circuit (about 0.085 second), the charge circuit is usually interrupted by relay K4 operating from the normal firing action before actual charging is initiated. If the Mk 11 gun does not cycle, the charging operation will continue to completion, bringing in two new live rounds, which will both fire immediately when the gun mechanism returns to battery position. Encountering a dud round usually causes the Mk 11 gun to fail to cycle, which allows the charging operation to be initiated and continue to completion, thus charging out the dud round. When the Mk 11 gun returns to battery position after charging, both barrels again resume firing immediately.

2-93. The automatic charging feature is eliminated from the system by removing the jumper on TB301 between pins 7 and 8.

2-94. SLOW FIRING RATE CIRCUIT. The slow firing rate of the Mk 11 gun is accomplished by interrupting the firing circuit for a short period of time after each cycle of the Mk 11 gun. The slow firing relay K6 in the control box, like the last round barrel relay K2, is energized each time the Mk 11 gun cycles, and has a de-energize time delay of approximately 0.16 second. Since the circuit for the first round barrel relay K1 passes through normally closed contacts on relay K6, firing will be interrupted as long as K6 is energized. Hence the sequence of operation is as follows:

1. Relay K1 energizes when the trigger is pressed.

2. The first round barrel fires and the Mk 11 gun cycles.

3. Relays K2 and K6 energize, causing relay K1 to de-energize before the gun mechanism returns to battery position.

4. The last round barrel fires and the Mk 11 gun stops.

5. After a delay of approximately 0.085 second, relay K2 fully de-energizes.

6. After a delay of approximately 0.160 second, relay K6 fully de-energizes and re-energizes K1.

7. Relay K1 is again energized, and the above sequence is repeated until the trigger is released.

2-95. For fast fire rate, the contacts on relay K6 must be shorted to render the slow firing rate circuits inoperative. This is accomplished with a SLOW-FAST switch (see figure 4-27) in the pod junction box.

2-96. MK 11 GUN CLEARING CIRCUIT. To clear the Mk 11 gun, it is necessary to stop the ammunition from feeding into the loader and to eject all live rounds from the chambers in the revolver cylinder of the gun mechanism. When the clear switch in the aircraft is closed, a solenoid valve on the loader is opened, which admits air into the clutch actuator cylinder and declutches the sprocket in the loader so that the ammunition belts no longer advance. At the same time, relay K7 in the control box closes, which energizes the charging circuit and causes the Mk 11 gun to cycle similarly to the charging operation described in paragraph 2-88, except that relay K5 is not operated and the charging operation is repeated each time the Mk 11 gun returns to battery position until the clear switch is released. A 1/2-second time period will allow the Mk 11 gun to charge a minimum of three times, which is necessary to completely clear all live ammunition from the chambers in the revolver cylinder of the gun mechanism. Clearing of the Mk 11 gun renders it inoperative.

CAUTION

Do not charge after clearing because a link jam will occur. During clearing, the links in the loader do not advance. If the loader is re-engaged after clearing, there will be no rounds in the revolver cylinder to eject into and decouple these extra links.

CHAPTER 3
INSTALLATION

3-1. PRE-INSTALLATION INSTRUCTIONS.

3-2. INSPECTION. Refer to table 3-1 for inspections required prior to initial gun pod installation on Naval combat aircraft. For routine preflight inspection, refer to Preflight Maintenance Checks, paragraph 5-15, and Maintenance Requirement Cards.

3-3. REPAIR OR REPLACEMENT. Sheet metal type damage found under the inspection of paragraph 3-2 shall be repaired using standard aircraft practices. Damaged parts shall be replaced in accordance with instructions of Chapter 5.

3-4. SERVICING. The gun pod may be serviced before or after installation on the aircraft. Servicing includes loading the magazine with ammunition and pressurizing the pneumatic reservoir. Servicing procedures are specified in Chapter 4.

TABLE 3-1. PRE-INSTALLATION INSPECTION

Component	Type of Damage	Type of Inspection
Pod Body	Impact damage to shell	Visual
Latch pins (for pod nose and pod tail attachment to pod body)	Impact damage, misalignment, or missing latch pins	Visual
Access and inspection doors	Malfunctioning latches or hinges; distorted doors	Operate latches and open and close doors; check for correct operation
Reservoir area	Corrosion	Visual
	Distorted, broken or missing tubing or pressure gage	Visual
Pod Nose	Impact damage to shell	Visual
Quick release latches	Mulfunctioning latch mechanism	Operate latches and check for correct operation and adjustment
Pod Tail	Impact damage to shell	Visual
Quick release latches	Malfunctioning latch mechanism	Operate latches and check for correct operation
Service door	Malfunctioning latch or hinge; distorted door	Operate latch and close door; check for correct operation and adjustment
Gun Mechanism	Impact damage to solenoid-operated charger valve	Visual
	Damaged electrical connectors	Visual
Barrels	Scored or rusted bore	Visual, after removal of cardboard cylinders from barrel bores, if present
Loader	Impact damage to loader frame	Visual
	Impact damage to solenoid-operated valves, including electrical connectors.	Visual

3-5. SPECIAL TOOLS.

3-6. The boresight tool provides an optical aim line for the gun pod based on the extended centerline of one of the barrel bores. The tool consists of a guide and an optical head. The guide matches and fits into the barrel in the pod and establishes an alignment for the optical head. The optical head views the target with magnification and a cross hair coincident with barrel aim line (see figure 3-1).



Figure 3-1. Boresight Tool

3-7. TRANSPORTING GUN POD TO AIRCRAFT. The Gun Pod Mk 4 Mod 0 may be transported to the aircraft on the Bomb Trailer Mk 7 Mod 1. (Refer to NAVWEPS OP 2173 (Volume 1) for information about the bomb trailer.) The bomb trailer can be modified for better adaptability for gun pod transportation with a Cradle Kit (BuWeps Drawing No. 1735771). This kit also converts the trailer into a maintenance stand when the standards are placed in the UP position as shown in figure 3-2. Aboard ship, a Bomb Skid Aero 21A1B or Bomb Truck Aero 33C/D with an Aero 62A platform can be used to transport the pod. In addition, the bomb truck can be used to hoist the pod to the aircraft. (Refer to NAVWEPS OP 2713.)

3-8. If the bomb trailer is used, the gun pod should be placed on the bomb trailer with the appropriate center of gravity marking (either for loaded or empty condition) directly over a midpoint on the bomb trailer jacking pad. The gun pod is secured in place by straps attached to the jacking pad.

3-9. The jacking pad must be in the fully retracted position whenever the bomb trailer is being towed with gun pod in place. The maximum towing speed for one bomb trailer is 15 miles per hour. The maximum speed is reduced to 5 miles per hour when two or more trailers are being towed.

3-10. INSTALLATION INSTRUCTIONS.

3-11. PREPARING AIRCRAFT EJECTOR RACK. Preparation of the ejector rack for gun pod installation must be in accordance with procedures specified



Figure 3-2. Gun Pod Mounted on Bomb Trailer with Standards Up

by the aircraft manufacturer in the aircraft maintenance manual. Because of safety provisions, these procedures must be read before attempting to install the gun pod on the aircraft.

3-12. PREPARING THE POD. The pod must be prepared for the particular installation as defined by the aircraft and the attaching location. Kits are supplied for each installation. They include sway brace pads; jettison feet, if required; lugs; miscellaneous and attaching hardware. The sway brace pads match the sway braces from the rack, provide proper alignment for the sway braces, and distribute the load and prevent localized damage to the pod skin. The jettison foot attaches to the pod and matches the ejection piston on the rack. The foot is built in and a part of the aft 14-inch lug pad on the A-4 aircraft installations. The lugs match the fit of the hooks of the rack and are of the correct length to provide the design aim line of the particular station at nominal lug setting providing no convergence is required.

3-13. The procedure for installing the kits for the A-4 aircraft center line is described in paragraph 3-14. The procedure is typical for all installations. A breakdown of components is shown in the IPB, OP 2719 (Volume 2), and the kits for different installations are also shown therein.

3-14. Mounting instructions for the 30-inch and 14-inch lug kits are identical except for location of lugs. Instructions given for the 30-inch installation are applicable to the 14-inch installation. Install the 30-inch mounting in accordance with the following instructions:

1. Install sway brace pads (see figure 3-3).

2. Remove protective cap (see 14-inch mounting position, figure 3-3) from the 30-inch forward lug mounting position by removing nut and screw (see figure 3-4) and lifting cap from pod body.

NOTE: Protective caps must be installed in the strong back bushings when the bushings are not being used for a particular (14-inch or 30-inch) lug mounting.

3. Push forward lug (1, figure 3-4) with lug pad (2) attached through opening in bushing (3) and position collar halves (4) so that halves fit over the bushing, and pin (5) extends through one of the holes in the collar.

4. Tighten bolts (6) and install safety wire.

5. Remove base end by removing bolts. Slide aft lug into aft lug base.

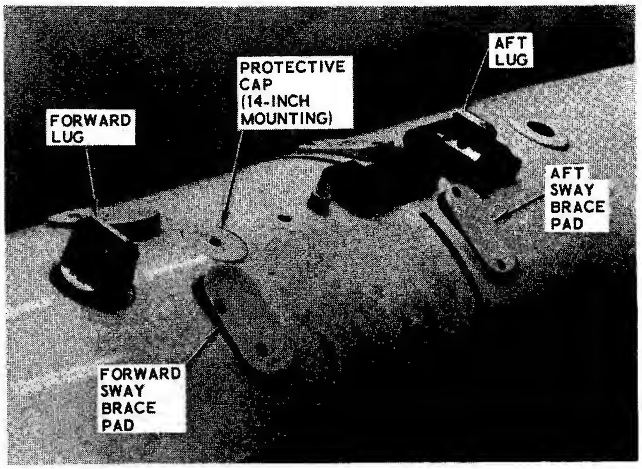


Figure 3-3. Gun Suspension Lugs

6. Install base end. Torque base end bolts to 80 ± 10 inch-pounds and install safety wire.

3-15. To preboresight the pod, adjust the lugs to match the correct indexes for the particular installation (see paragraph 2-81 for a general discussion of boresighting and paragraph 3-6 for use of special tool). The method of adjusting is as follows:

1. Rotate the collar beneath the front lug until the correct index is read on the left hand side of the forward lug (see figure 3-5). Each detent corresponds to approximately 1/4 mil elevation or depression on the forward 30-inch lug and approximately 1/2 mil on the forward 14-inch lug. Each increment inscribed on the lug is equivalent to 5 mils.

2. Insert a 5/32-inch Allen wrench into the adjusting screw for the aft lug and rotate until the proper index mark on the pad aligns with the centerline inscribed on the aft lug (see figure 3-6). Push lug aft for this adjustment. Each increment on the pad corresponds to 5 mils. The adjusting screw is detented and each detent corresponds to approximately 0.6 mil on the aft 30-inch lug and approximately 1.25 mil on the aft 14-inch lug.

3-16. LOCATING GUN POD. Locate the bomb trailer with gun pod underneath the aircraft, using care to avoid damage to aircraft and gun pod. Raise the gun pod toward the aircraft, checking carefully before contact for alignment of gun pod lugs and ejector rack hooks. Move the bomb trailer as required to correct alignment.

CAUTION

Do not remove straps from gun pod until after ejector racks have closed on gun pod lugs, and the sear indicators show that gun pod is secured to the aircraft.

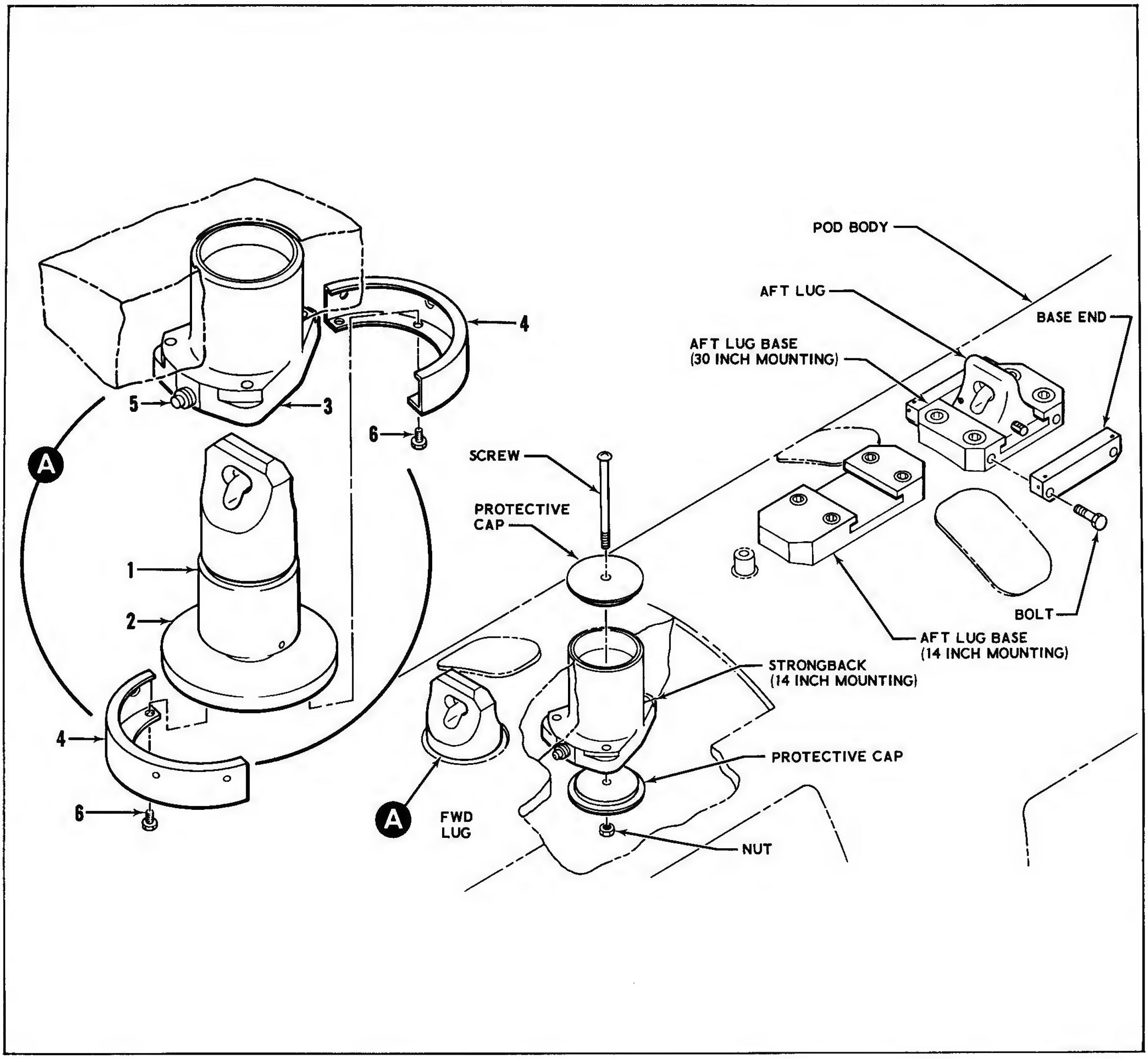


Figure 3-4. 30-Inch Lug Kit Installation

3-17. Raise and secure the gun pod to the aircraft. Remove the straps around the gun pod and lower the jacking pad to the retracted position. Remove the bomb trailer from the vicinity of the aircraft.

3-18. ADJUSTING SWAY BRACES. Procedures for tightening the ejector rack sway braces against the pads on the gun pod are shown in the aircraft maintenance manual. They must be followed carefully for proper alignment of the installed gun pod.

3-19. Boresight Check. Should a boresight check be required to establish the accuracy of the rack alignment or to provide more accurate boresighting, the following steps should be taken (see paragraph 2-81 for a discussion of boresighting procedure).

1. Set up the aircraft and its boresight board or target system in accordance with the particular aircraft procedures.

2. Loosen the sway braces to the pod.

3. Install boresight tool into the muzzle of the barrel (upper or lower, depending on aircraft manual instructions).

4. Aim pod by adjusting lugs (refer to paragraph 3-15) until aim line established by boresight tool intersects target.

NOTE: Rotate tool 180 degrees to eliminate any optical error, and resight. Average out any error.

5. Tighten sway braces per aircraft practice.

6. Check boresight and readjust, if necessary.

7. Remove boresight tool.

WARNING

Boresight tool must be removed before firing gun pod.

3-20. INSTALLATION CHECKOUT.

3-21. GUN POD FUNCTION. Check out the installed gun pod by observing the following instructions:

1. Fill reservoir with air or nitrogen gas. Refer to paragraph 4-10 for detailed servicing instructions.

2. Connect pocket charger (see figure 5-3) to plug receptacle on top of pod body.

3. Charge Mk 11 gun by depressing button on pocket charger.

4. Check revolver cylinder for free and smooth cycling and verify that the revolver cylinder advances one station with one charger impulse.

5. Disconnect pocket charger from pod body.

6. A complete preflight maintenance check shall be performed proir to flight (refer to paragraph 5-15 and MRC set).

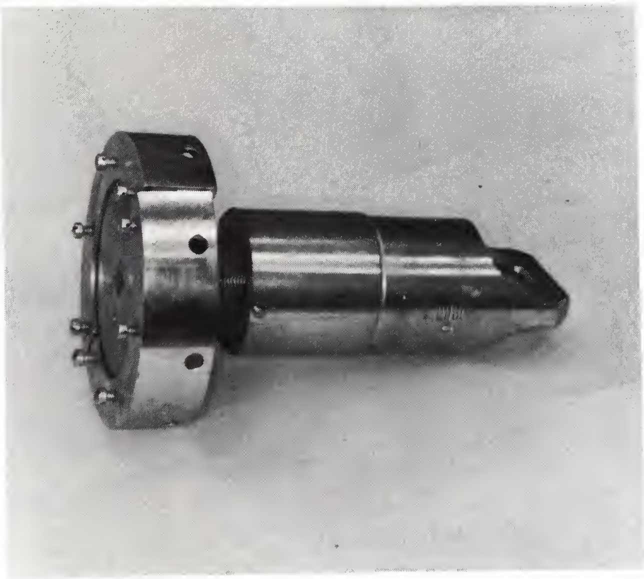


Figure 3-5. Forward Lug Indexes

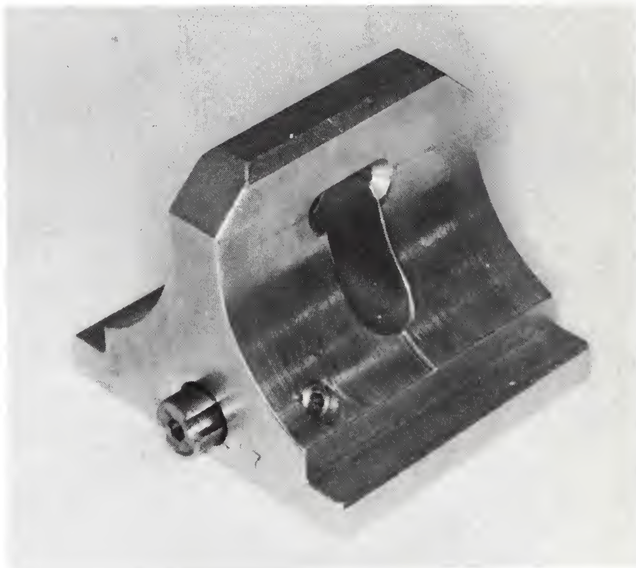


Figure 3-6. Aft Lug Index

CHAPTER 4
OPERATION

4-1. GENERAL OPERATION.

4-2. This chapter includes the information and procedures needed to use the Gun Pod Mk 4 Mod 0. The material covers the loading of ammunition into the Mk 6 link, preparing the gun pod for firing, and shut down procedures. Loading the ammunition into the link includes the step-by-step procedures for using the Mk 11 Link Loading Machine or the alternate hand loading procedure. Preparing the gun pod for firing includes loading the gun pod with ammunition, loading the Mk 11 gun, and preparing system details for firing. Shut down procedures describe disarming the gun mechanism, down loading the gun pod and shutting off the pneumatic supply. For instructions on operation of the gun pod as a weapon system refer to the flight manual for the aircraft on which the gun pod is mounted.

4-3. DETAILED OPERATING PROCEDURES.

4-4. PREPARATION FOR USE. Preparing the gun pod for use includes belting (positioning rounds in links), linking (joining links), magazine loading and charging the pneumatic reservoir. Special tools and accessory equipment (refer to paragraph 4-5) are provided to assist the user in preparing the gun pod for use.

4-5. Special Tools and Accessory Equipment. Refer to table 4-1 for a list of special tools and accessory equipment required to prepare the gun pod for operation.

4-6. Link Loading Machine Mk 11 Mod 0. Inserting 20MM Mk 100 series ammunition into belted Mk 6 ammunition links may be accomplished with or without the aid of the link loading machine (see figure 4-1). The link loading machine may be used to remove (debelt) cartridges from belted links (refer to paragraph 4-22). Instructions for inserting ammunition into belted links are given in paragraph 4-7. An illustration of personnel and equipment positions during operation of the link loading machine is provided (see figure 4-7).

TABLE 4-1. SPECIAL TOOLS AND ACCESSORY EQUIPMENT FOR OPERATION

Nomenclature	Part No.	Function	Fig. No.	Refer to Paragraph No.
Link Loading Machine Mk 11 Mod 0	2471477	Mechanically insert rounds into or remove rounds from links	4-1	4-7
Linking Tool	2537757	Assemble links into belt or connect links	4-2	4-9, step 3
Delinking Tool	2537758	Disconnect ammunition links	4-2	4-9, step 15
Debelting Tool	2537759	Remove rounds from links	4-2	
Loading Tools (2 each required)	2471405 and 2471406	Assist in guiding ammunition into magazine during loading	4-3	4-9, step 7
Loading Trays (1 each required)	2310663 and 2310664	Guide ammunition to feed throat adapters during loading	4-4	4-9, step 7
Ammunition Sprocket Crank	2471154	Rotate sprockets for loading of ammunition belts	4-5	4-9, step 6
Magazine Indexing Crank	2248420	Rotate magazine for loading of ammunition belts	4-6	4-9, step 4

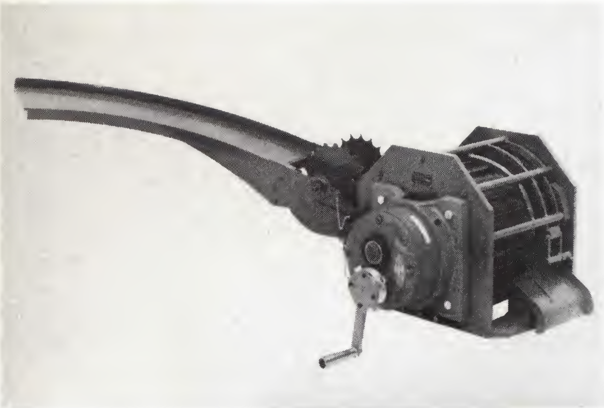


Figure 4-1. Link Loading Machine Mk 11 Mod 0



Figure 4-4. Loading Trays

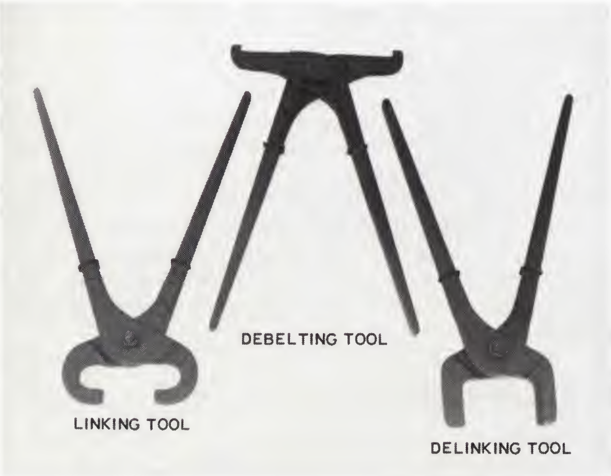


Figure 4-2. Hand Loading Tools

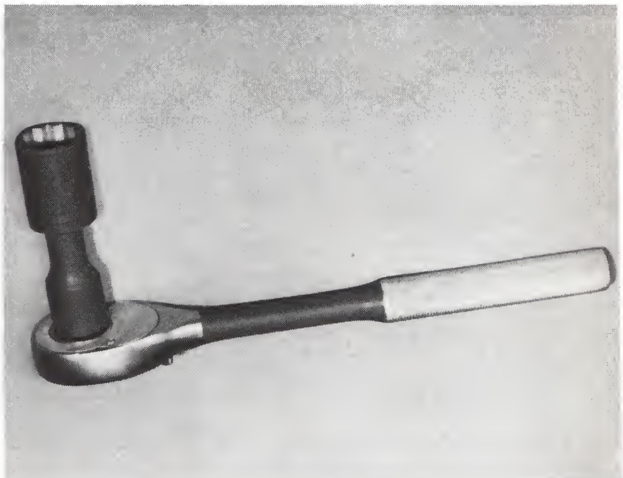


Figure 4-5. Ammunition Sprocket Crank



Figure 4-3. Loading Tools



Figure 4-6. Magazine Indexing Crank

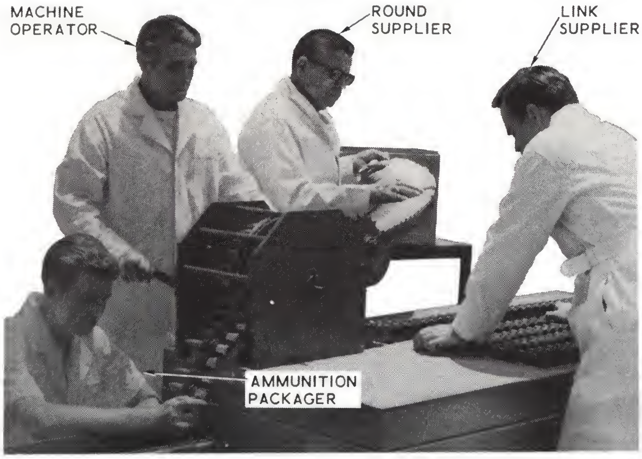


Figure 4-7. Link Loading Machine Operating Personnel Positions

4-7. The procedure for inserting ammunition into the belted links using the link loading machine is as follows:

1. Fill pan assembly (7, figure 4-8) until round in bottom of pan assembly is covered with wax (Trewax liquid 108-12).

NOTE: Do not allow wax to drop to a level below mid line of the projectile of the bottom round. Projectile case necks must be coated with wax to prevent malfunctions (broken cartridge case necks or cases stuck in revolver cylinder chamber) during ejection.

2. Open belting gate (1, figure 4-8) and debelting gate (1, figure 4-9).

3. Route links (2, figure 4-8) through link tray (3) and position first link between teeth in link sprocket.

4. Close belting gate (1), locking first link in sprocket.

5. Rotate crank (2, figure 4-9) clockwise until first link is positioned opposite ammunition chute (4, figure 4-8).

WARNING

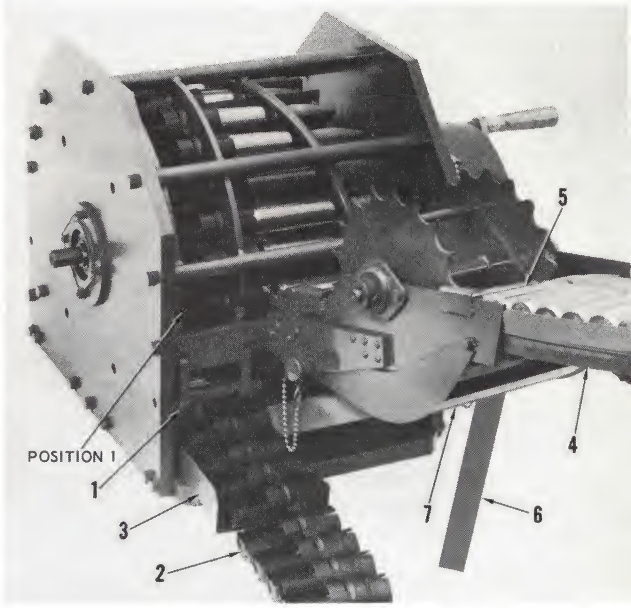
Although cartridge primers are designed to be fired by electrical impulses, it is possible that they may also be fired by high impact, static electricity, and exposure to electromagnetic energy. When loading HEI rounds into links use extreme caution to prevent impacts to the round that would damage the fuze.

6. Load cartridges (5) into chute.

NOTE: First cartridge must be aligned with first link in POSITION 1 (see figure 4-8).

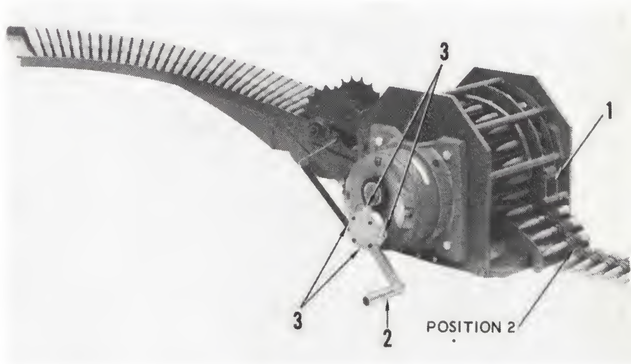
7. Rotate crank clockwise and make certain a cartridge is fed into POSITION 1 for each link.

8. Close debelting gate (1, figure 4-9) when first link reaches POSITION 2 (see figure 4-9).



1. BELTING GATE
2. LINK
3. LINK TRAY
4. AMMUNITION CHUTE
5. CARTRIDGE
6. STOP
7. PAN ASSEMBLY

Figure 4-8. Link Loading Machine (Feed Side)



1. DEBELTING GATE
2. CRANK
3. SCREW AND CHECK NUT

Figure 4-9. Link Loading Machine (Delink Latch Side)

9. Continue rotating crank and checking cartridges and links at POSITION 1 until ammunition is inserted into a complete link segment.

CAUTION

If link loading machine hangs up and rounds are properly positioned, do not adjust clutch. Refer to paragraph 5-63, fault isolation, and table 5-8.

NOTE: Belted Mk 6 Mod 4 links are supplied in 50-round segments. Belted link segments are joined to form ammunition belts when the magazine is loaded (refer to paragraph 4-9, step 11).

10. Place stop (6, figure 4-8) across ammunition chute to prevent cartridges in feed chute from entering POSITION 1 (figure 4-8) while links are being positioned.

4-8. Hand Loading Links. The procedure for inserting ammunition into the belted links without using the link loading machine is as follows:

1. Insert cartridge into first link.

WARNING

Although cartridge primers are designed to be fired by electrical impulses, it is possible that they may also be fired by high impact, static electricity, and exposure to electromagnetic energy. When loading HEI rounds into links use extreme caution to prevent impacts to the round that would damage the fuze.

2. Press cartridge into link until the cartridge groove is contained by the indentation in the link and the cartridge base is flush against the base of the link.

3. Repeat steps 1 and 2 for each link and cartridge until an ammunition belt of the desired length is constructed.

4-9. Magazine Loading. The magazine may be loaded with or without the gun pod installed on an aircraft. The minimum magazine loading time is obtained if magazines are loaded prior to installing gun pod on aircraft. Two ammunition belts are loaded simultaneously into the magazine. Load the magazine with one belt on each side of the gun pod, in accordance with the following instructions:

1. Remove ejection tubes (refer to paragraph 5-29, steps 3 and 4).

2. Insert a cartridge into a trailing Mk 6 Mod 6 link (see figure 4-10).



Figure 4-10. Link Identification

3. Attach a trailing link with cartridge on the end of each of the two ammunition belts using linking tool (see figure 4-11).

NOTE: Figure 4-11 illustrates the attaching of a leading link. The procedure is typical for attaching all types of links.



NOTE:
TYPICAL ATTACHMENT PROCEDURE FOR LEADING AND TRAILING LINK

Figure 4-11. Attaching Link Using Linking Tool

4. While depressing ammunition feed clutch lever (see figure 4-12), insert magazine indexing crank (see figure 4-6) as shown in figure 4-13. Open magazine index door.

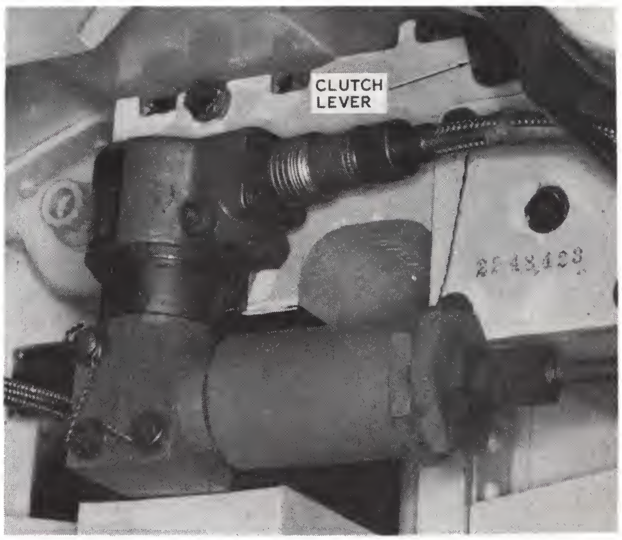


Figure 4-12. Ammunition Feed Clutch Lever

5. Rotate magazine indexing crank until cradles formed by hooks on magazine segment are aligned with opening in feed throat (see figure 4-14).

6. Insert ammunition sprocket crank (see figure 4-5) as shown in figure 4-13.

NOTE: Instructions given here are for insertion of ammunition sprocket crank on left side of gun pod. Ammunition sprocket crank may be used on right side of gun pod by observing these instructions except all references to "counterclockwise" must be converted to clockwise and "clockwise" references converted to counterclockwise.

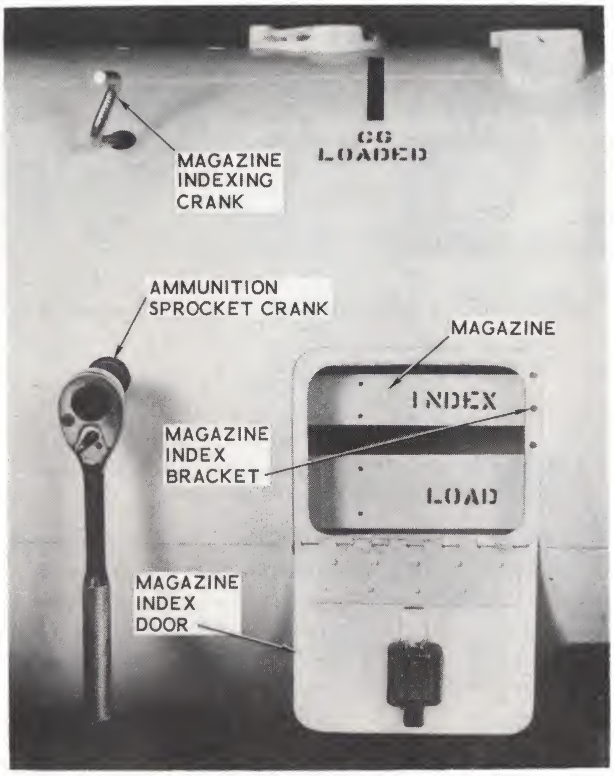


Figure 4-13. Magazine Loading Setup

7. Install upper and lower loading tools in feed throats (see figure 4-3) and left and right loading trays (see figure 4-4) as shown in figure 4-15.

NOTE: Check position of cradles formed by hooks on magazine segment. Cradles must be aligned with opening in feed throat. If cradles are not aligned, repeat step 5.

8. Feed ammunition belt (see figure 4-16) into feed throat with trailing link and cartridge entering throat first. Feed ammunition belt into throat until trailing link engages the ammunition drive sprocket.

9. Rotate sprocket crank counterclockwise until trailing link seats in cradle formed by hooks on magazine segment.

10. Hold trailing links firmly seated in hooks by applying pressure with sprocket crank and rotate magazine indexing crank clockwise until magazine segment marked LOAD (see figure 4-13) is aligned with the magazine index bracket.

11. Feed ammunition, in 50-round segment, into magazine by rotating sprocket crank counterclockwise. Attach additional 50-round segments of ammunition links using linking tool (see figure 4-11) as required until magazine segment is filled.

NOTE: Visually check for filled magazine segments at small aft inspection ports on each side of pod body.

12. Relax pressure on sprocket crank and rotate magazine indexing crank clockwise until cradles formed by hooks on next segment are aligned with opening in feed throat.

13. Seat link with cartridge in hook cradle and repeat steps 10 through 13 until magazine is fully loaded.

14. When magazine is fully loaded, note last link in throat; crank out belt to provide space to separate belt forward of noted link (both belts) with hand delinking tool (see figure 4-17).



Figure 4-14. Magazine Segment Alignment



Figure 4-15. Left Hand Loading Tray Installed



Figure 4-16. Ammunition Positioned for Magazine Loading

15. Rotate sprocket crank counterclockwise until first round clears loading trays.

16. Unlatch loading trays and slide out from feed throat adapters and remove upper and lower loading tools (see figure 4-3).

17. Install an empty Mk 6 Mod 5 leading link (see figure 4-10).



Figure 4-17. Removing Link Using Delinking Tool

WARNING

The first two rounds following empty leading link must be either target practice (TP) or armor piercing tracer (AP T) rounds.

18. If belts are not loaded with target practice (TP) or armor piercing tracer (AP T) rounds, remove first two cartridges in ammunition belt, using the debelting tool (refer to paragraph 4-23). Insert TP or AP T rounds in first two links following the empty leading link (refer to paragraph 4-8).

19. Rotate sprocket crank counterclockwise until empty leading link is clear of outer throat adapter leading edge (see figure 4-18).

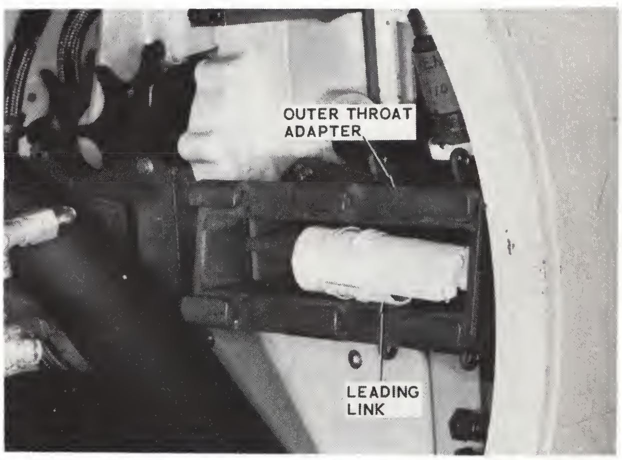


Figure 4-18. Leading Link in Position

20. Rotate the magazine clockwise until the word "INDEX" aligns with the magazine index bracket (see figure 4-13).

21. Remove magazine indexing crank and close magazine index door.

22. Install ejection tubes, reversing instructions given in paragraph 5-29, step 3.

4-10. Pneumatic System Charging. Fill reservoir and charge the pneumatic system in accordance with the following instructions:

1. Set air valve handle (see figure 4-19) to OFF position.

2. Remove valve cap from reservoir manifold (1, figure 4-20).

3. Attach a source of air (per Military Specification MIL-P-5518) or nitrogen (per Military Specification MIL-W-6011) to valve (3).

4. Set ground charging relief of 3975 psig maximum at full delivery of air or nitrogen source.

5. Rotate 3/4 inch hex nut (4) counterclockwise to open valve.

6. Fill reservoir to pressure of 3200 ± 200 psig.

7. Rotate 3/4 inch hex nut clockwise and torque to 60 ± 10 inch-pounds.

8. Remove air or nitrogen source.

9. Install valve cap.

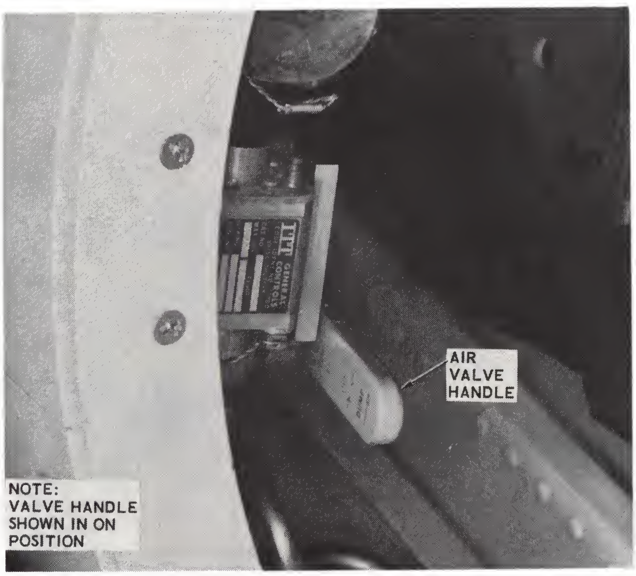
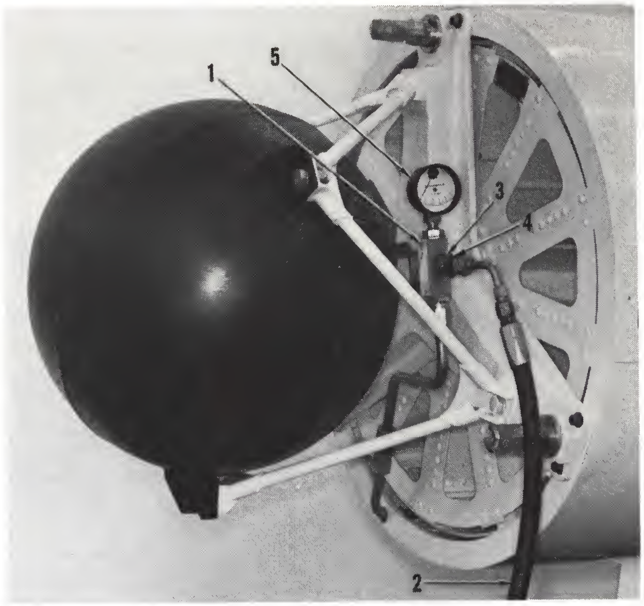


Figure 4-19. Valve and Tray Assembly Control Handle



1. RESERVOIR MANIFOLD
2. NITROGEN SOURCE
3. VALVE
4. 3/4 INCH HEX NUT
5. PRESSURE GAUGE

Figure 4-20. Filling Pneumatic Reservoir

4-11. PRE-OPERATIONAL CHECKOUT. Prior to operation, the gun mechanism must be armed, and a visual inspection of electrical, pneumatic and mechanical system performed.

4-12. Arming Gun Mechanism. With the magazine loaded as described in paragraph 4-10, arm the gun mechanism by observing the following instructions:

1. Insert Mk 103 dummy rounds into the gun cylinder at each ram station (see figures 4-21 and 4-22).

CAUTION

Dummy rounds must be inserted far enough into revolver cylinder so latches (see figures 4-21 and 4-22) are aft of the cartridge cases.

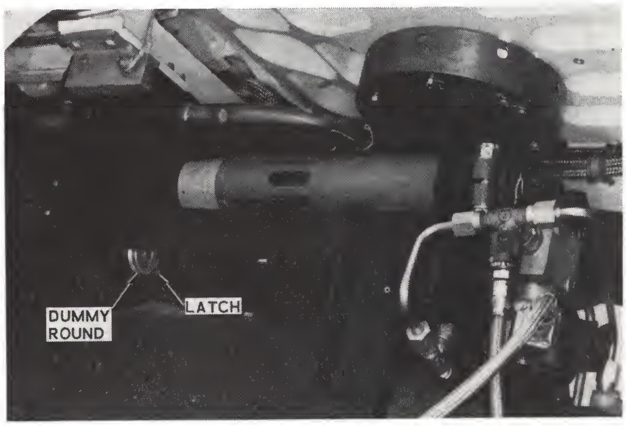


Figure 4-21. Dummy Round Positioned in First Round Ram Station

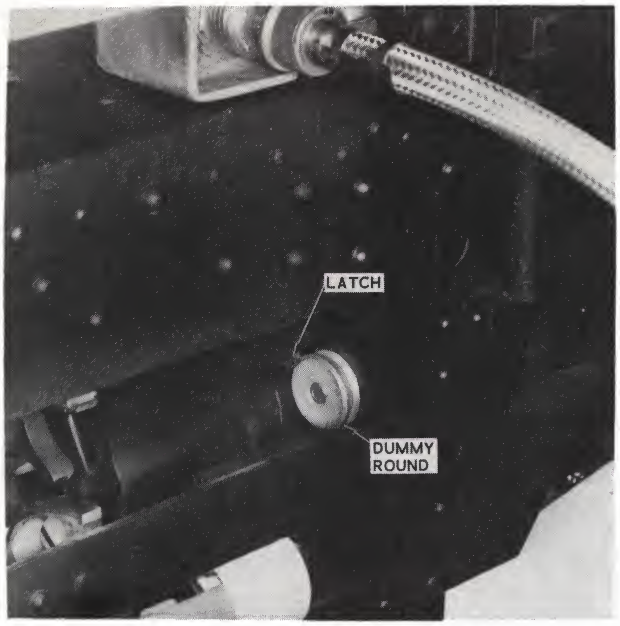


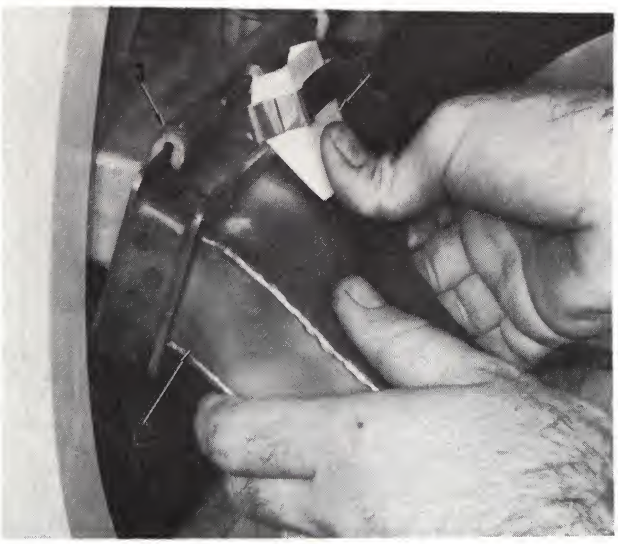
Figure 4-22. Dummy Round Positioned in Last Round Ram Station

2. Open aft feed chute latch (1, figure 4-23) and slide feed chute (2) into throat adapter (3) groove until latch engages adapter.

3. Depress forward feed chute latch pins (1, figure 4-24) and attach forward latches to loader side plates (2) at four attachment points.

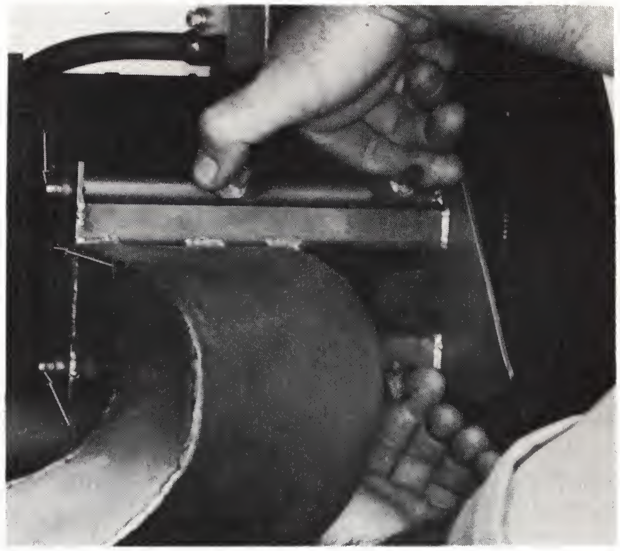
CAUTION

Make certain all four forward latch pins are engaged on each feed chute.



1. LATCH
2. FEED CHUTE
3. THROAT ADAPTER

Figure 4-23. Attaching Feed Chute Aft Latch



1. LATCH PIN 2. SIDE PLATE

Figure 4-24. Attaching Feed Chute Forward Latch

4. Rotate sprocket crank (see figure 4-13) clockwise and move ammunition forward through feed chutes to loader (see figure 4-25) until leading links are firmly positioned against the loader sprockets.

NOTE: Ammunition belts must move freely from magazine through feed chutes and into loader.

5. Maintain pressure on ammunition belts with sprocket crank and disengage loader sprocket cam nut as follows:

a. Insert screwdriver between nut (1, figure 4-26) and loader.

b. Apply prying force at nut (1) so nut, spacer (2), bolt (3) and rod (4) are moved aft.

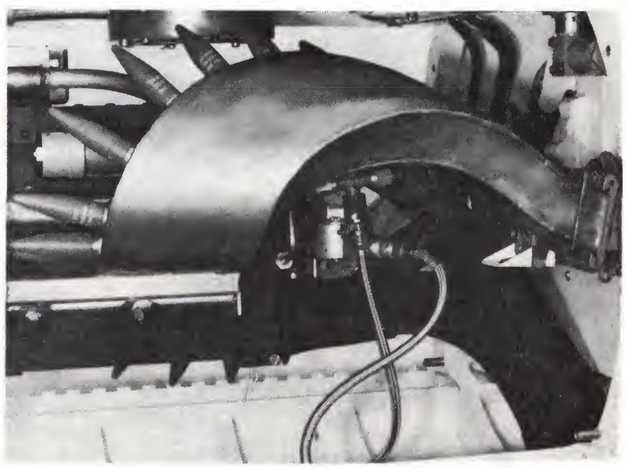
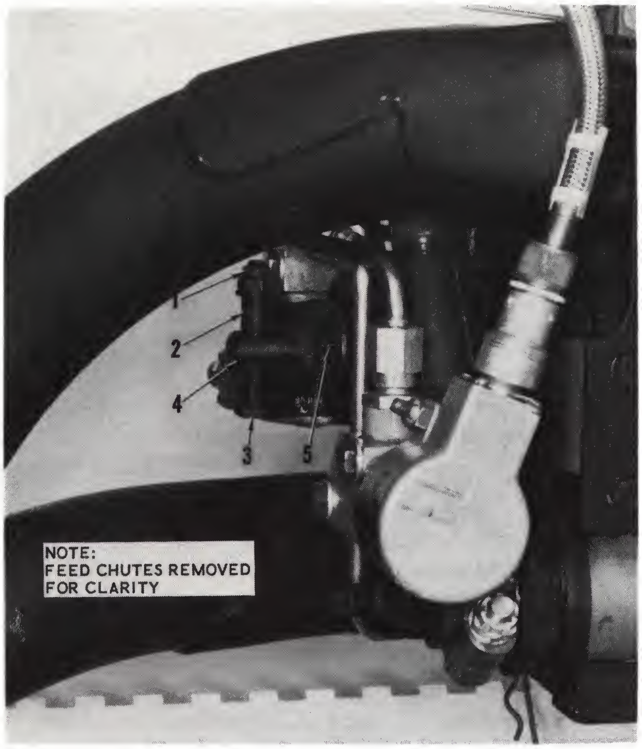


Figure 4-25. Ammunition Positioned in Feed Chutes

c. Maintain prying force and rotate cam nut (5) until spacers are pulled out of grooves in cam nut and aligned with the flat surface of cam nut to disengage loader sprockets. Remove screwdriver. Figure 4-26 shows loader sprocket cam nut in disengaged position.



1. NUT 3. BOLT 5. CAM NUT
2. SPACER 4. ROD

Figure 4-26. Loader Sprocket Disengaged

6. With cam nut disengaged, advance ammunition belts, with sprocket crank, until empty leading link is positioned directly aft of hand-loaded dummy rounds. Remove sprocket crank.

CAUTION

Empty leading link must be positioned directly aft of the hand-loaded dummy round.

7. Insert screwdriver as described in step 5a, and pry nut (1) aft as described in step 5b.

8. Maintain prying force and rotate cam nut (5) until spacers (2) are aligned with grooves in cam nut (5).

9. Release prying force and position spacers in grooves on cam nut.

CAUTION

Make certain clutch is re-engaged.

10. Set rate of fire switch (see figure 4-27) for fast (4,000 rounds per minute) or slow (700 rounds per minute).

11. Verify that all pneumatic connections are made. Set air valve handle (see figure 4-19) to ON position.

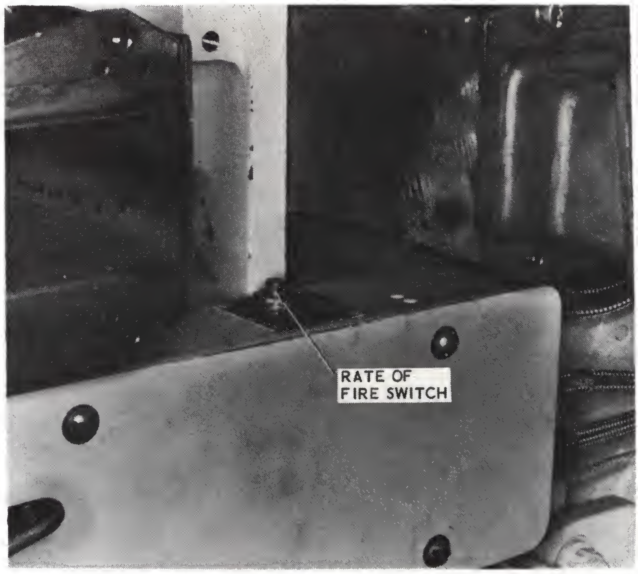


Figure 4-27. Rate of Fire Control

12. Install pod body main access doors (see figure 2-1).

NOTE: Forward latch on left hand door will not close with valve handle in DUMP or OFF position. To prevent pneumatic system from leaking, the air valve handle should be left in OFF position until gun pod and Mk 11 gun are ready to use.

13. Connect pod-to-aircraft electrical connector at top of gun pod.

4-13. TYPICAL OPERATION. For operation instructions, refer to the flight manual for the aircraft on which the gun pod is mounted.

4-14. SHUTDOWN. This section provides instructions for clearing the gun mechanism, loader and feed chutes of live cartridges and fired cartridge cases, after the aircraft has returned from a mission. Provisions are made for the pilot to clear the gun mechanism by activating a clear switch in the cockpit. When the pilot activates the clear switch all cartridges and cases are ejected from the gun mechanism, and any cartridges in the loader and feed chutes remain stationary. The following shutdown procedures include shutdown instructions for gun mechanisms which have been cleared prior to landing, and for gun mechanisms which have not been cleared prior to landing. Shutdown procedures are also provided for gun pods returning with ammunition in magazine, and gun pods returning without ammunition in magazine.

4-15. Preparation for Shutdown. The following instructions must be observed as general shutdown procedures to determine the specific shutdown procedure to be followed:

WARNING

Do not attempt to clear rounds from revolver cylinder in RAD HAZ area.

1. Remove pod-to-aircraft electrical connector at top of gun pod.

2. Open pod door main access doors.

3. Set air valve handle (see figure 4-19) to OFF position.

4. Visually inspect gun mechanism, loader, feed chutes, and magazines for cartridges and expended cases.

5. Refer to table 4-2 for number of paragraph related to specific shutdown procedures.

TABLE 4-2. SHUTDOWN PROCEDURE REFERENCE LIST

Condition of Gun Pod	Refer to Paragraph
No cartridges in gun mechanism, loader, feed chutes, or magazine.	4-16
No cartridges in gun mechanism, loader, feed chutes, or magazine. Two empty cases in gun cylinder eject stations and two links in loader.	4-17
No cartridges or cases in gun mechanism. Cartridges in loader, feed chute and magazine.	4-18
Four cartridges and two cases in gun mechanism, six links in loader. Cartridges in feed chutes and magazine.	4-19

4-16. Gun Mechanism Cleared, Magazine Emptied. When full complement of ammunition is fired and gun mechanism cleared prior to shutdown, observe the following instructions:

1. Remove feed chutes by reversing feed chute installation procedure as described in paragraph 4-12, steps 2 and 3.

4-17. Gun Mechanism Not Cleared, Loader, Feed Chutes and Magazine Empty. When full complement of ammuniton is fired and gun mechanism not cleared prior to shutdown, observe the following instructions:

1. Remove feed chutes by reversing feed chute installation procedure as described in paragraph 4-12, steps 2 and 3.

2. Pry empty cases from revolver cylinder.

3. Disconnect ejection tubes from loader by following ejection tube disassembly instructions as described in paragraph 5-29, step 3.

4. Remove links and empty cases from loader.

5. Connect ejection tubes to loader, reversing instructions given in paragraph 5-29, step 3.

4-18. Gun Mechanism Cleared, Cartridges in Loader, Feed Chute and Magazine. When full complement of ammunition is not fired and the gun mechanism cleared prior to shutdown, observe the following instructions:

1. Depress aft feed chute latch (1, figure 4-23) and slide feed chute away from loader so latch does not engage adapter.

2. Depress four forward feed chute latch pins (1, figure 4-24) and pull feed chute away from loader. Pulling feed chute away from loader will separate ammunition contained in feed chutes from ammunition in magazine.

NOTE: It may be necessary to insert the ammunition sprocket crank (see figure 4-13) to adjust the belts so the separation point at each feed chute and feed throat adapter is aligned.

3. Remove feed chute from pod body. Allow ammunition in feed chute to slide from feed chute and remain attached to the loader.

4. Disengage loader sprocket cam nut (refer to paragraph 4-12, step 5).

5. Pull ammunition belts from loader.

6. Engage loader sprocket cam nut (refer to paragraph 4-12, steps 7 through 9).

7. Remove ammunition belts from magazine by installing the sprocket crank and rotating ratchet to feed ammunition out of magazine (see figure 4-13).

NOTE: If magazine is to be reloaded immediately or stored in loaded condition, new belts can be coupled to those already in the magazine and the magazine filled and reindexed (refer to paragraph 4-9).

4-19. Gun Mechanism Not Cleared, Cartridges in Loader, Feed Chute and Magazine. When full complement of ammunition is not fired and the gun mechanism not cleared prior to shutdown, observe the following instructions:

1. Depress aft feed chute latch (1, figure 4-23) and slide feed chute away from loader until latch does not engage adapter.

2. Depress four forward feed chute latch pins (1, figure 4-24) and pull feed chute away from loader thus separating ammunition contained in feed chutes from ammunition in magazine.

NOTE: It may be necessary to insert the sprocket crank (see figure 4-13) to adjust the belts so the separation point between feed chutes and feed throat adapter are aligned.

3. Remove feed chute from pod body. Allow ammunition in feed chute to slide from feed chute and remain attached to the loader.

4. Disengage loader sprocket cam nut (refer to paragraph 4-12, step 5).

5. Pull ammunition belts from loader with three empty links on each belt.

6. Engage loader sprocket cam nut (refer to paragraph 4-12, steps 7 through 9).

7. Pry cartridges from ram stations and cases from eject stations.

8. Set air valve handle (see figure 4-19) to ON position.

9. Using pocket charger (refer to paragraph 5-8) or aircraft controls, charge Mk 11 gun over one station.

CAUTION

If aircraft control system is used for charging, disconnect electrical cable (2, figure 5-81) to prevent ammunition drive from pulling ammunition out of magazine during charge cycle.

10. Set air valve handle (see figure 4-19) to OFF position.

11. Pry cartridges from ejection stations.

12. Remove ammunition belts from magazine by installing the sprocket crank (see figure 4-13) and rotating sprocket crank to feed ammunition out of magazine.

NOTE: If magazine is to be reloaded immediately or stored in loaded condition, new belts can be coupled to those already in the magazine and the magazine filled and reindexed. (Refer to paragraph 4-9.)

4-20. POST SHUTDOWN PROCEDURES.

4-21. POST FLIGHT PROCEDURES. The post flight procedures are described in detail in paragraph 5-16. If removal of cartridges from links (debelting) is desired, the link loading machine or hand tools may be used. Instructions for using the link loading machine for debelting are given in paragraph 4-22. Instructions for using hand tools for debelting are given in paragraph 4-23.

4-22. Use the link loading machine for debelting in accordance with the following instructions:

WARNING

Although cartridge primers are designed to be fired by electrical impulses, it is possible that they may also be fired by high impact, static electricity, and exposure to electromagnetic energy.

1. Position first link with cartridge in POSITION 2 (see figure 4-9) and close debelting gate.

2. Rotate crank counterclockwise.

3. As cartridges reach POSITION 1 (see figure 4-8), remove them from the link loading machine. Empty links will drop through link tray (3, figure 4-8).

4-23. Use the debelting tool for debelting in accordance with the following instructions:

1. Attach debelting tool as shown in figure 4-28.

2. Pry cartridge from link.

3. Repeat steps 1 and 2 until desired number of cartridges is removed.



Figure 4-28. Removing a Cartridge Using Debelting Tool

CHAPTER 5
MAINTENANCE

5-1. INTRODUCTION.

5-2. This chapter provides the information needed to maintain the Gun Pod Mk 4 Mod 0. Included is information concerning the failure reporting methods, parts identification, and a list of special tools and test equipment together with the different maintenance procedures and checks, parts inspection, adjustments, fault isolation and instructions for the disassembly and assembly of the major components and pod systems.

5-3. FAILURE REPORTS. Components that fail in service or which have a history of malfunction must be reported. Failure reports shall be prepared in accordance with BUWEPS INSTRUCTIONS 13070. 1B.

5-4. PART NUMBER IDENTIFICATION. Part number identification may be established with the Illustrated Parts Breakdown, Volume 2 of this publication.

5-5. PARTS REPLACEMENT SCHEDULE: A parts replacement schedule appears in Appendix A.

5-6. SPECIAL TOOLS AND TEST EQUIPMENT.

5-7. SPECIAL MAINTENANCE TOOLS. Refer to table 5-1 for a list of special tools required for maintenance.

5-8. POCKET CHARGER. The pocket charger (see figure 5-3) is a rechargeable power supply and switch for charging or cycling the Mk 11 gun in the gun pod. The charger is a flashlight size battery power unit equipped with a switch for gun charging at the end opposite the lead. It provides a safety feature in that charging is controlled at the gun pod. The pocket charger is used as follows:

1. Decouple the aircraft lead (if the gun pod is aircraft mounted) from the top of the gun pod.

2. Install the plug of the pocket charger into the receptacle at the top of the gun pod.

3. Inspect the Mk 11 gun and loader compartment and ensure that the system is clear, and ready for charging.

TABLE 5-1. SPECIAL MAINTENANCE TOOLS

NOMENCLATURE	PART NO.	FUNCTION	FIG. NO.	REFER TO PARAGRAPH NO.
Ramming Mechanism Holding Fixture	2471287	Provide a mounting bracket to position and retain ramming mechanism during assembly and disassembly	5-1	5-37, step 6
Latch Depressing Tool	1634004	Provide leverage required when opening pod nose and tail section latches	5-2	5-27
Pocket Charger	2471380	Charge or cycle the Mk 11 gun in the gun pod when the Mk 11 gun is not electrically connected to an aircraft	5-3	5-8, 5-9
Control Box Tester Mk 38	2471381	Functionally check out control box	5-4	5-10
Gun Pod Tester Mk 39	2471292	Check function of gun pod without firing rounds	5-5	5-19
Barrel Insert Removal Tool	2537752	Provide leverage required to pull barrel inserts out of barrels	5-6	5-36, step 20
Ring Seal Removal Tool	2537611	Provide grip for ring seal removal	5-7	5-36, step 11

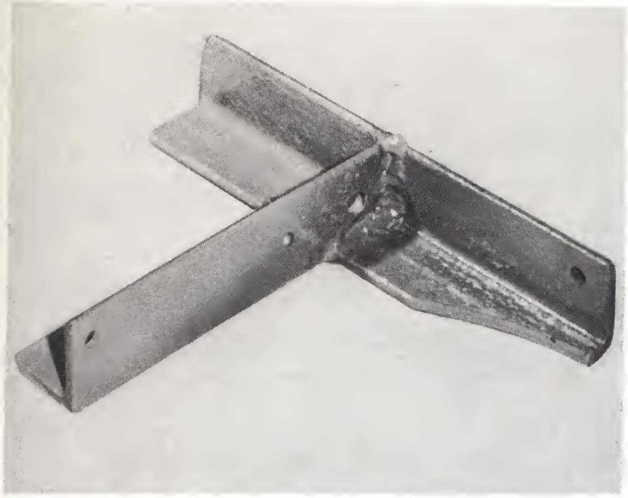


Figure 5-1. Ramming Mechanism Holding Fixture



Figure 5-2. Latch Depressing Tool



Figure 5-3. Pocket Charger and Adapter



Figure 5-4. Control Box Tester Mk 38



Figure 5-5. Gun Pod Tester Mk 39

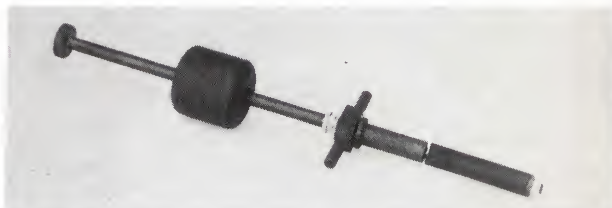


Figure 5-6. Barrel Insert Removal Tool



Figure 5-7. Ring Seal Removal Tool

4. Set air valve handle (see figure 4-19) to ON position.

5. Charge the Mk 11 gun by depressing the button on the pocket charger.

6. Remove the pocket charger from the gun pod receptacle to prevent inadvertent charging.

5-9. The power to actuate the relays within the gun pod is provided by a 24V DC battery within the pocket charger. The battery when fully charged is capable of approximately 200 gun charge cycles. The battery can be recharged by plugging into a standard 115V AC power source. An adapter (see figure 5-3) is used to connect the pocket charger to the power source. The pocket charger may be left connected to the 115V AC supply when not in use to ensure a fully charged state. Leaving the pocket charger connected to a power source will not overcharge the battery.

NOTE: Pneumatic motor solenoid is not energized when pocket charger is used.

5-10. CONTROL BOX TESTER MK 38 MOD 0. The control box tester (see figure 5-4) is an electronic test unit which is used to functionally test the control box. The control box tester is not generally used for routine checkout. The tester is used only prior to installing a new control box, or for fault isolation if a malfunction occurs (refer to paragraph 5-63). Instructions below are provided to prepare the control box tester for test. The steps listed are based on the control box under test not being installed in the gun pod. A control box may be tested in the gun pod by omitting steps 1, 2 and 3 of paragraph 5-11 and step 8 of paragraph 5-12.

1. Tag and disconnect all electrical cable connections to control box (1, figure 5-8).

2. Remove 4 bolts (2), 4 washers (3) and shield (4).

3. Remove 6 bolts (5) and 6 washers (6), and remove control box (1) from gun pod.

4. Connect control box (1, figure 5-9) to control box tester (2) with branched cable (3).

5. Set AC and DC power switches to OFF and set gun toggle switch to SAFE.

6. Connect 28V DC power to jacks next to 28V DC lamp on control box tester panel (see figure 5-9). Connect positive DC lead to red jack marked + and negative lead to black jack immediately below + jack.

7. Connect 115V 400 cps power to jacks next to 115V AC lamp on control box tester panel, connecting the ground lead to black jack (see figure 5-9).

8. Set DC and AC power switches to ON (see figure 5-9).

9. Set FAST FIRE-SLOW FIRE switch to FAST FIRE.

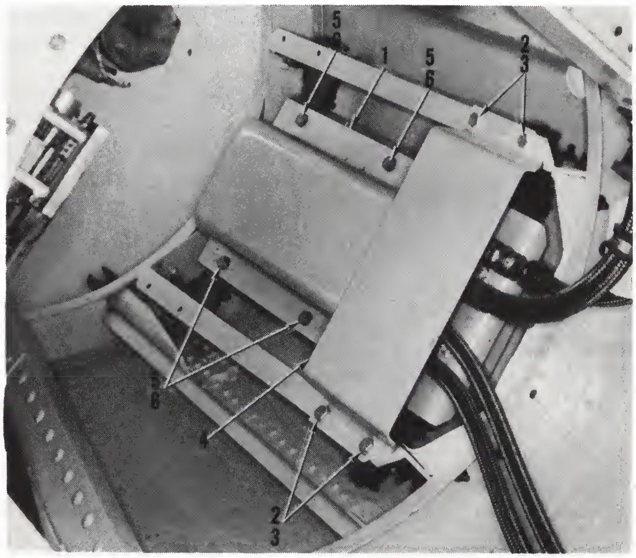
5-11. Control Box Functional Test. Perform control box functional test as follows:

1. Mnaual charging test - Set gun switch to READY. AIR MOTOR SOLENOID, RAM SOLENOID and CHARGE SOLENOID must actuate once only.

2. Master arm continuity test - Make sure that MASTER ARM SWITCH is in OFF position. Depress TRIGGER button. Verify that READY indicator is the only light on and that no solenoids actuate.

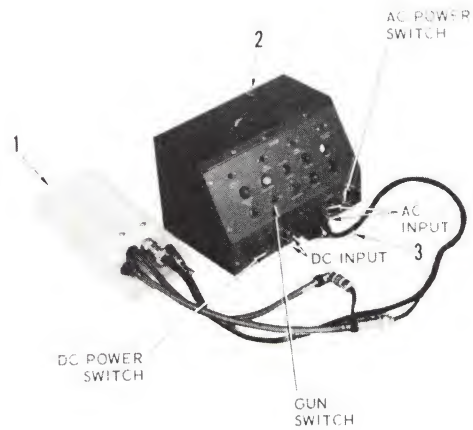
3. Firing test - Set MASTER ARM SWITCH to ON and depress TRIGGER button. AIR MOTOR SOLENOID must actuate, and FIRST FIRE indicator must light before LAST FIRE indicator. Release TRIGGER button. FIRST FIRE indicator must go off before LAST FIRE indicator.

4. Automatic charging test - Set AUTO CHARGE switch to AUTO CHARGE and hold TRIGGER button down while depressing DUD button. FIRST FIRE and LAST FIRE indicators must be on while DUD button is depressed, and RAM SOLENOID and CHARGE SOLENOID must actuate. Release trigger and DUD button.



1. CONTROL BOX
2. BOLT
3. WASHER
4. SHIELD
5. BOLT
6. WASHER

Figure 5-8. Control Box Installed



1. CONTROL BOX
2. CONTROL BOX TESTER MK 38 MOD 0
3. BRANCHED CABLE

Figure 5-9. Control Box Connected to Control Box Tester

5. Clearing test - Hold gun switch in CLEAR position for approximately one second. LOADER CLUTCH SOLENOID must actuate, RAM SOLENOID and CHARGE SOLENOID must cycle in and out and FIRST FIRE and LAST FIRE indicators must not light.

6. Repeat steps 1 through 5 above with FAST FIRE-SLOW FIRE switch set to SLOW FIRE position. In steps 3 and 4, FIRST and LAST FIRE will blink on and off as long as trigger is held.

7. Disconnect control box from tester.

8. Install control box in gun pod by installing parts removed in paragraph 5-10, steps 1 through 3.

5-12. GUN POD TESTER MK 39 MOD 0. The gun pod tester is an electronic test unit which is used to functionally test the electrical and pneumatic systems of the gun pod and to test the associated aircraft electrical control system and its compatibility with the gun pod. Power for operation of the gun pod tester may be obtained from either internal or external sources. For external source operation, plug in the external power cable and connect the leads to a 24 volt DC and a 115 volt, 400 cycle supply. Select EXT on the power switches.

CAUTION

Verify that polarity and ground connections are made correctly.

For internal power operation, set power switches to INT; 24 volt power is then obtained from a nickel-cadmium rechargeable battery. 115 volt, 400 cycle power is obtained from an inverter which is fed by the battery. The battery should not be allowed to reach a discharged condition. The state of charge of the battery may be observed by setting both power switches to INT and checking the AC voltage on 1Ø, which should read approximately 130 volts with no load. The DC voltage will not be indicated without a pod cable being plugged in. The battery may be charged by leaving both power switches in the OFF position, connecting the battery charge cable and plugging it into a 115 volt AC source. A complete charge is obtained in approximately 16 hours. The charge may be left on for several days with no damage to the battery. For general usage it is recommended that an overnight charge be given daily. To check the aircraft electrical supply to the gun pod, perform the following:

1. Disconnect the aircraft electrical plug from all gun pods. Place all switches on the gun pod tester to the OFF or neutral position.

2. Connect the aircraft cable to the gun pod tester and one aircraft bomb rack plug.

3. Place the gun pod tester in the aircraft cockpit and use an appropriate method of bypassing aircraft landing gear interlock circuit.

4. Select the desired pod circuit with the aircraft pod selector switch.

5. Turn aircraft AC and DC power circuits on.

6. Set aircraft master gun switch to ON.

7. Set aircraft gun-clear switch to READY; the gun pod tester JUMPER, READY ON, and the AØ, BØ, and CØ lights must come on. The DC system voltage must be indicated on the DC voltmeter and the AC voltage on the AC voltmeter when the phases are selected by the AC-VM PHASE SEL. switch.

8. Actuate the aircraft trigger switch; the gun pod tester TRIGGER ON light must come on.

9. Set the aircraft gun switch to CLEAR; the gun pod tester CLEAR ON light must come on and the JUMPER and READY ON lights must go off.

10. Repeat steps 4 through 9 on remaining aircraft pod systems after relocating the gun pod tester aircraft cable receptacle.

11. Secure aircraft circuits and remove the gun pod tester.

5-13. MAINTENANCE CHECKS.

5-14. The Maintenance Requirement Card (MRC) set for the gun pod specifies maintenance requirements. In those instances where a conflict between the manuals and the MRC set exist, the MRC shall prevail. Maintenance checks covered in this manual include servicing, preflight, postflight and periodic maintenance. Servicing checks are those activities required to load the magazine with ammunition and to pressurize the pneumatic reservoir. The detail steps for this effort are described in Chapter 4. Preflight maintenance is provided to ensure gun pod is ready for flight. Post flight maintenance is provided to ensure the gun pod is in a safe state and to visually check for malfunctions. Periodic maintenance is provided to assist personnel in disassembling and assembling the gun pod. Instructions for inspecting, cleaning, and lubricating are given, as applicable to each type of maintenance.

5-15. PREFLIGHT MAINTENANCE CHECKS. The objective of the preflight checks is to perform the final operations to ready the gun pod for flight, and includes visual checks, loading the Mk 11 gun and connecting the gun pod electrically to the aircraft. The checks include the following steps, which are described in detail in Chapter 4, or in the maintenance manual covering the aircraft on which the gun pod is being mounted.

1. Check boresight alignment setting. (Refer to paragraph 3-15 and to the maintenance manual covering the aircraft on which the gun pod is being mounted.)

2. Install gun pod on the aircraft, if not already installed. (Refer to Chapter 3.)

3. Check sway brace torque. (Refer to the maintenance manual covering the aircraft on which the gun pod is being mounted.)

4. Check electrical and mechanical connections within the gun pod for security. Visually inspect interior of gun pod as visible from access doors.

5. Check exterior of gun pod for damage that may have occurred during handling or since maintenance checks.

6. Set air valve handle (see figure 4-19) to ON position.

7. Charge over the Mk 11 gun with the pocket charger (check for a single charge cycle). Refer to paragraph 5-8 for use of pocket charger.

TABLE 5-2. LUBRICANTS

LUBRICANT NO.	NAME OF LUBRICANT	USE OF LUBRICANT	SOURCE OF MANUFACTURER
1	Lubricating Oil, General Purpose	Phosphated surfaces of gun mechanism and loader, rammers and pneumatic motor	VV-L-800
2	Lubriplate 215	General - All bearing surfaces	Fiske Bros. Refining Co., Newark, New Jersey
3	XP 190 Grease	Rammer damper springs	Joseph Dixon Crucible Co., Jersey City, New Jersey
4	XP 271 Grease	Rammer damper springs	Joseph Dixon Crucible Co., Jersey City, New Jersey
5	Lubricating Grease	Packing O-rings and boss connection gaskets	MIL-G-4343

8. Verify that air supply pressure gauge (5, figure 4-20) reads 3200 ± 200 psig and recharge reservoir if necessary (refer to paragraph 4-10).

9. Arm the gun mechanism (refer to paragraph 4-12).

10. Close all access doors and secure all latches.

11. Connect the gun pod electrically to the aircraft.

5-16. POST FLIGHT MAINTENANCE CHECKS. The post flight checks include disconnecting the gun pod electrically from the aircraft, assuring that the Mk 11 gun is clear, and ascertaining if a malfunction has occurred. The checks can also include removing the gun pod from the aircraft if removal is required or if a malfunction so dictates. The physical steps involved are described in detail in Chapter 4 and are as follows:

1. Disconnect the electrical aircraft-to-pod cable at the gun pod.

2. Check to be sure the Mk 11 gun is cleared. (If the Mk 11 gun is not cleared, refer to paragraphs 4-17 and 4-19.)

3. Set air valve handle (see figure 4-19) to OFF position.

4. Remove loader, visually inspect loader and aft end of gun, and reinstall.

5. Oil rams in accordance with instructions given in paragraph 5-46, step 6, using Lubricant No. 1 (refer to table 5-2) as shown in figure 5-90.

6. Clean and oil barrel bores.

7. Remove gun pod from aircraft if required.

8. Measure gun barrel bore and barrel insert in accordance with instructions given in table 5-4. Replace, if necessary.

9. Visually inspect gun pod interior and exterior.

10. Replace parts as required in step 9 above and correct any malfunctions noted under step 2 above. (Refer to paragraph 5-63 for fault isolation).

11. Replace any parts as required in parts replacement schedule (refer to Appendix A).

TABLE 5-3. CLEANSERS

CLEANSER	USE OF CLEANSER	SPECIFICATION
Rifle bore cleaner	Bore, chamber and gas port	MIL-C-372
Solvent	General cleanser	P-D-680, Type I
Finger print remover	Barrel exterior	MIL-C-15074

5-17. LUBRICANTS. Refer to table 5-2 for the list of lubricants.

5-18. CLEANSERS. Refer to table 5-3 for the list of cleansers.

5-19. PERIODIC MAINTENANCE CHECKS. The periodic checks cover disassembly, inspection, cleaning, lubrication and assembly of the gun mechanism and loader. The periodic checks are performed at 3000 round increments and include the following steps:

1. Remove loader and gun mechanism as described in paragraphs 5-30 and 5-31. Disassemble loader and gun mechanism as described in paragraphs 5-37 and 5-38.

2. Inspect pod body for corrosion. Clean and inspect pod assembly and removed parts. (Refer to Table 5-4, Inspection.)

3. Replace parts as required by the inspection above and as listed in Appendix A for the number of rounds fired.

4. Reassemble gun mechanism and loader. Lubricate gun mechanism and loader during reassembly (refer to table 5-2, table 5-5, and paragraphs 5-43 through 5-46).

5. Mount gun mechanism in the pod body by installing parts in reverse order of removal (refer to paragraph 5-31).

6. Connect the gun junction box electrical cable (1, figure 5-19) to the gun junction box (3) connect the

pneumatic line (2, figure 5-20) to the charger valve (3) and position pneumatic line in stored position (see figure 5-16).

WARNING

Be sure that the charger valve electrical cable (1, figure 5-20) is not connected to the charger valve on forward end of Mk 11 gun.

7. Connect the gun pod tester pod cable to the gun pod main connector.

8. Install the firing pin voltage indicator (see figure 5-10) between the revolver and the firing pins on the right-hand side, and connect the sequencing switch shorting plug to the sequencing switch electrical control box cable (2, figure 5-19) that normally connects to the sequencing switch receptacle on the gun junction box. Set SLOW-FAST fire switch (see figure 4-27) on the pod junction box to SLOW. Set DC and AC power selector switches on the gun pod tester (see figure 5-5) to INT, the gun switch to READY and MASTER ARM switch to MASTER ARM.

CAUTION

Do not actuate the TRIGGER switch for more than 10 seconds because of possible damage to transformers in the control box. Allow a minimum cooling period of one minute between operations.

9. Actuate the TRIGGER switch on the gun pod tester. Only the last fire indicator lamp should light (see figure 5-10).

10. Set the SLOW-FAST fire switch (see figure 4-27) on the pod junction box to FAST. Actuate the TRIGGER switch on the gun pod tester (see figure 5-5). First and last fire voltage indicator lamps should light (see figure 5-10).

11. Set the SLOW-FAST fire switch (see figure 4-27) to SLOW, remove the sequencing switch shorting plug (figure 5-10) from the control box lead, and attach the CABLE to the sequencing switch electrical cable (2, figure 5-19) receptacle. With the gun pod tester TRIGGER switch actuated, only the first fire voltage indicator lamp (see figure 5-10) should light.

12. Turn gun pod tester MASTER ARM switch to OFF, gun switch to SAFE, and power selector switches to OFF. Remove firing pin voltage indicator. Set SLOW-FAST fire switch on pod junction box to FAST.

13. Install the loader (installation is the reverse of loader removal procedures; see paragraph 5-30) and connect all pneumatic fittings to Mk 11 gun and loader.

14. Set valve handle (see figure 4-19) to ON and check all system couplings for leaks. If the pod assembly has had a history indicating pneumatic leaks, check pneumatic fittings with soap solution or other suitable means.

15. Connect all electrical connections (see figures 5-15, 5-19 and 5-20) except the connector at the charger valve electrical cable (1, figure 5-20) at the front of the Mk 11 gun.

16. Set the gun pod tester DC and AC power selector switches to INT and MASTER ARM switch to MASTER ARM. Set the gun switch to READY. Air should be felt escaping around the rams. Return the gun switch to the SAFE position.

17. Insert last round switch actuator in the mouth of the feed chute to actuate the last round switch (19, figure 5-22).

CAUTION

Extensive and costly damage will result from high pneumatic motor speed resulting from more than momentary no-load operation.

WARNING

Alert personnel in the area to the high frequency sound that results when the pneumatic motor is operated with no load. Do not operate pneumatic motor more than a fraction of a second.

18. Momentarily place the gun pod tester gun switch to READY and return to SAFE. The pneumatic motor should operate momentarily.

CAUTION

When performing the following operation, use care not to overtravel to the READY position.

19. Momentarily place the gun pod tester gun switch to CLEAR and return to SAFE. Loader clutch should function and should lock the sprocket.

WARNING

Personnel are to stay clear of the central pod area during the succeeding operations.

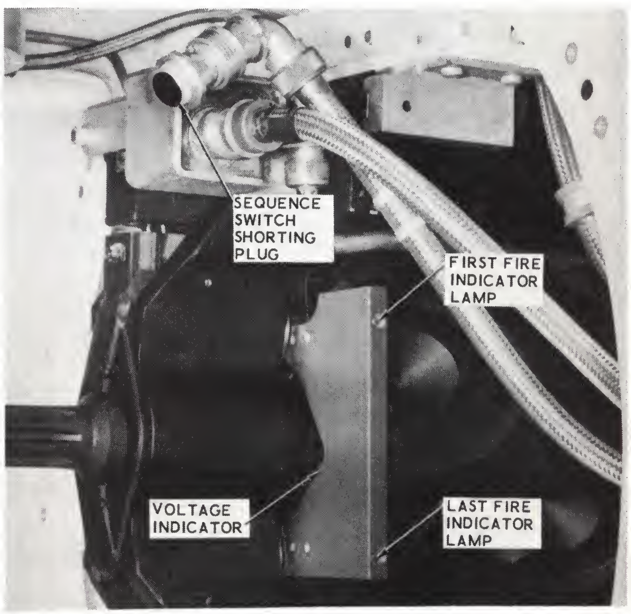


Figure 5-10. Firing Pin Test Setup

20. Connect the charger valve electrical cable (1, figure 5-20) at the front of the Mk 11 gun. Place the gun pod tester gun switch to READY. The Mk 11 gun should cycle once and the pneumatic motor should operate. Check cams on the revolver for indexing to assure that only one charge cycle was obtained.

CAUTION

Extensive and costly damage will result from high pneumatic motor speed resulting from more than momentary no-load operation.

21. Momentarily actuate the TRIGGER switch on the gun pod tester. The Mk 11 gun should auto-charge and the pneumatic motor should operate.

22. Place the gun pod tester gun switch to CLEAR for a maximum of 1/2-second. The Mk 11 gun should charge cycle as long as the switch is held.

23. Turn the gun pod tester MASTER ARM switch to OFF, the gun switch to SAFE, and the power selector switches to OFF. Disconnect the gun pod tester from the pod body. Remove the last round switch actuator.

24. Replace pod nose and tail.

25. Oil the pneumatic motor and rams with Lubricant No. 1 (refer to table 5-2).

26. Set air valve handle (see figure 4-19) to OFF.

27. Fill the pneumatic reservoir to 3200 ± 200 psi (refer to paragraph 4-10).

5-20. The lubrication of the gun mechanism and loader includes all surfaces except those of the damper ring springs and pneumatic components. The ring springs normally will not require relubrication for the life of the parts. Because all pneumatic components are lubricated at the factory and at overhaul, scheduled parts replacement satisfies most lubrication requirements. Only the rams and pneumatic motor require lubrication during post flight maintanence checks (refer to paragraph 5-16, step 4 and Table 5-5).

5-21. OVERHAUL. Overhaul instructions for the 20MM Gun Pod Mk 4 Mod 0 are provided in Volume 3.

5-22. OPERATIONAL TESTS.

5-23. General operational tests for the gun pod consist of checks performed during preflight maintenance checks (refer to paragraph 5-15, steps 1 through 11). Detail operational tests consist of checks performed during periodic maintenance checks (refer to paragraph 5-19, steps 5 through 26).

5-24. COMPONENT REPLACEMENT.

5-25. Disassembly instructions and the accompanying photographs and drawings in this section are provided to assist personnel in disassembling the three maj components of Gun Pod Mk 4 Mod 0 (pod body, g mechanism and loader). Instructions provided are f complete disassembly of the components to gain acce to the replaceable spares assemblies. The informati necessary to establish the need for the replacement any part can be determined from Table 5-4, Inspectic and the Parts Replacement Schedule, Appendix

5-26. GUN POD DISASSEMBLY. The initial steps f disassembling the gun pod are the removal of the p nose and pod tail to provide access to the pod boc and the removal of the Mk 11 gun and loader.

5-27. Pod Nose and Pod Tail Sections Removal. R move the pod nose section and pod tail section accordance with the following instructions:

1. Insert latch depressing tool (see figure 5-2) each pod nose section latch, as shown in figure 5-1 and pry latches open.

2. Separate pod nose section from pod body.

3. Insert latch depressing tool in each pod tail secti latch, as shown in figure 5-11, and pry latches ope

4. Separate pod tail section from pod body.

5-28. Blast Suppressor Insert Removal. Remove t blast suppressor inserts from the blast suppress mounted on the pod nose section in accordance with t following instructions:



Figure 5-11. Opening Pod Nose and Tail Section Latches

1. Remove setscrews (1, figure 5-12) and push blast suppressor orifices (2) into blast suppressor (3).

2. Remove insert from blast suppressor through any one of the ports on sides of blast suppressor.

5-29. Gun Barrel Removal. Gun barrels may be removed without disassembling gun mechanism either to replace barrels, barrel inserts, or to facilitate pod handling. Remove gun barrels in accordance with the following instructions:

1. Disconnect electrical lead (1, figure 5-20) and pneumatic line (2, figure 5-20).

2. Depress push button (5, figure 5-49) and rotate locking lever (6) to REL (unlocked) position.

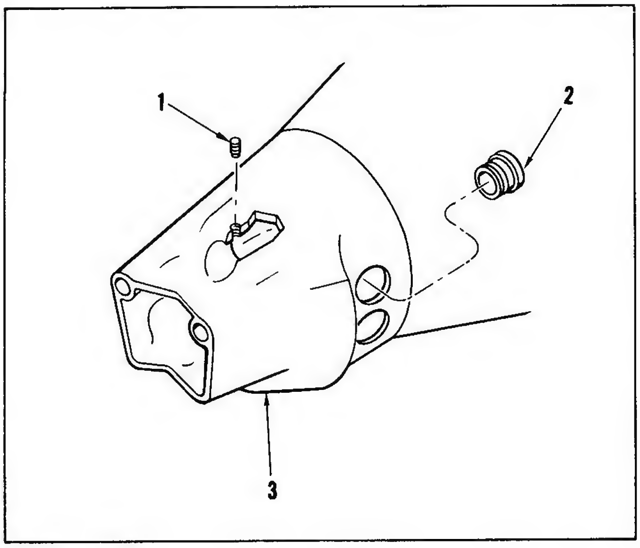
3. Slide booster housing (7) off barrels.

NOTE: If difficulty is encountered in removing booster housing from receiver, insert pry bar between booster housing and receiver, between the barrels, and pry booster housing loose.

4. Rotate barrels (approximately 60 degrees) until barrels are free from breech assembly, and pull barrels from the receiver.

CAUTION

Before reinstalling barrels, make certain ring seals in revolver cylinder are in place.



1. SETSCREW
2. INSERT
3. BLAST SUPPRESSOR

Figure 5-12. Blast Suppressor Insert Removal

5-30. Loader Removal. Remove the loader from the pod body in accordance with the following instructions:

NOTE: Instructions provided describe removal of loader and gun mechanism individually, the loader being removed through the main access door and the gun mechanism being removed through the forward end of the pod body. It should be noted that the gun mechanism and loader may be removed as one unit through the forward end of the pod body.

1. Open latches (1, figure 5-13) on pod body main access door (2) and open main access doors on each side of pod body.

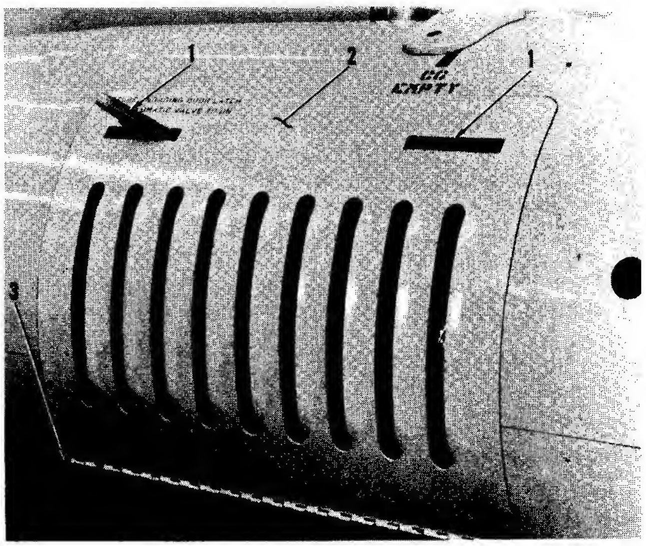
NOTE: Doors may be removed by removing the hinge pin (3). The doors may be reinstalled without hinge pins without affecting gun pod structural integrity or door retention during operation.

2. Set air valve handle (see figure 4-19) to DUMP position.

3. Rotate latches (1, figure 5-14), lift upper ejection tube (2) and lower ejection tube (3) from eject tube guide and remove ejection tube from pod body.

4. Disconnect pneumatic line (1,figure 5-15) by rotating ferruled nut on connector and pulling connector away from receptacle.

NOTE: The pneumatic disconnects are designed with a pneumatic self locking feature. Before disconnecting pneumatic lines, the pneumatic pressure must be relieved (refer to paragraph 5-30, step 2).



1. LATCH
2. MAIN ACCESS DOOR
3. HINGE PIN

Figure 5-13. Main Access Door Latches

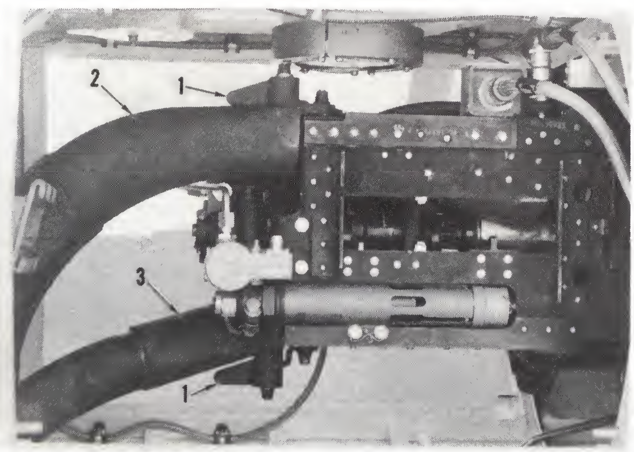
5. Disconnect electrical cables (2 and 4) from declutch valve (3) and rammer valve (5).

NOTE: To disconnect electrical cable tube, grasp sleeve and pull connector out of receptacle.

6. Place pneumatic line (1, figure 5-15) in stored position (see figure 5-16).

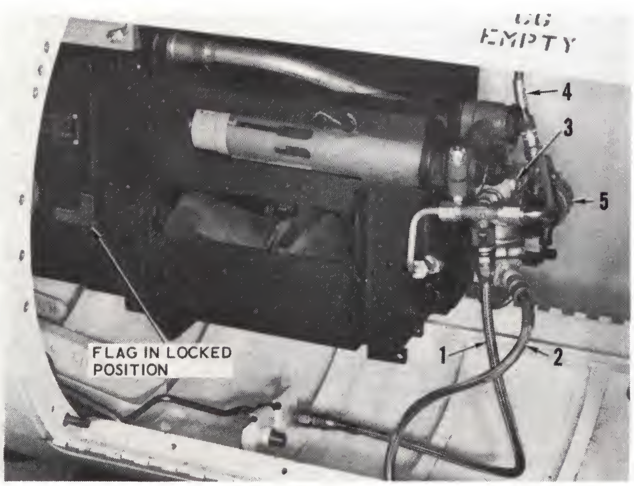
7. Pull loader lock flags (see figure 5-16) down and rotate flag until red strips are visible.

8. Pull loader away from gun mechanism at loader to gun mechanism attachment points (see figure 5-17) and lift loader out of pod body through main access door (see figure 5-18).



1. LATCH
2. UPPER EJECTION TUBE
3. LOWER EJECTION TUBE

Figure 5-14. Ejection Tube Removal



1. PNEUMATIC LINE
2. ELECTRICAL CABLE
3. DECLUTCH VALVE
4. ELECTRICAL CABLE
5. RAMMER VALVE

Figure 5-15. Loader Electrical and Pneumatic Line Removal

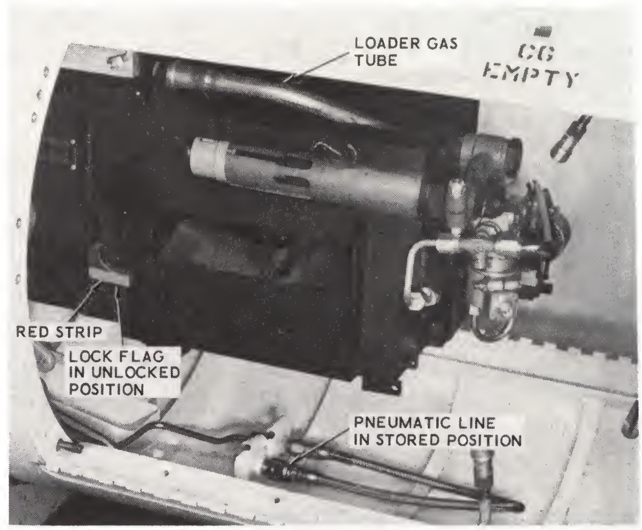


Figure 5-16. Loader Pneumatic Line in Stored Position

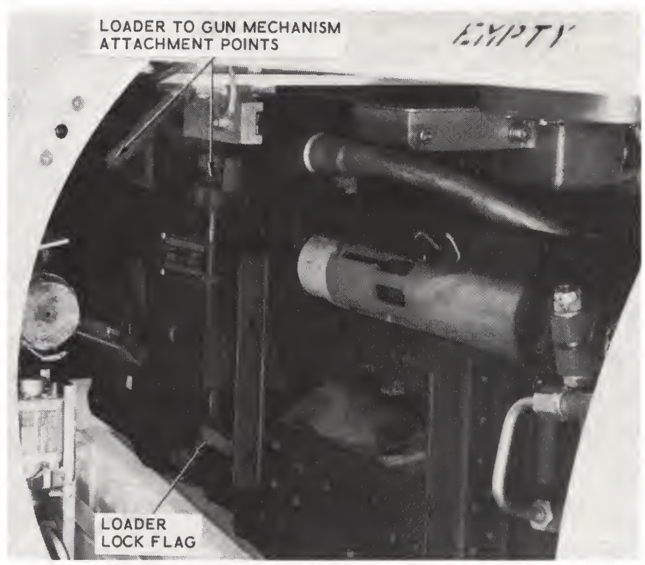


Figure 5-17. Loader to Gun Attachment



Figure 5-18. Loader Removal

5-31. Gun Mechanism Removal. Remove the gun mechanism from the pod body in accordance with the following instructions:

NOTE: Instructions provided are for removal of gun mechanism after loader removal. However, the gun mechanism may be removed with the loader attached.

1. Disconnect electrical cables (1 and 2, figure 5-19) from gun junction box (3).

2. Disconnect charger valve electrical cable (1, figure 5-20) and pneumatic line (2) from charger valve (3).

NOTE: Pneumatic disconnects are designed with a pneumatic self locking feature. Before disconnecting pneumatic lines, the pneumatic pressure must be relieved (refer to paragraph 5-29, step 2).

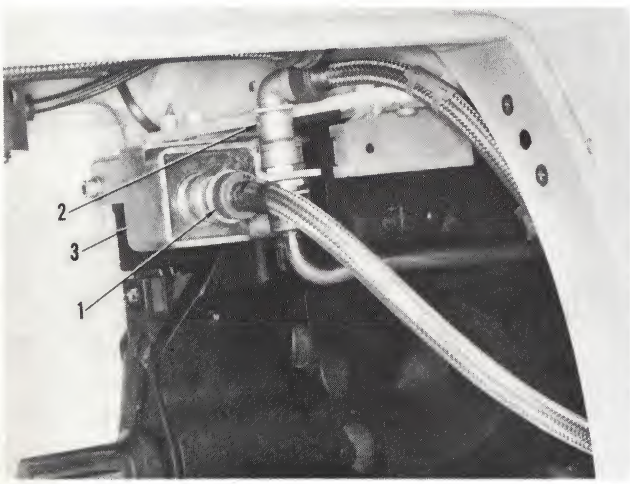
3. Unlock upper trunnion by pulling upper trunnion lock (1, figure 5-21) up.

4. Unlock lower trunnion by pulling lower trunnion lock (2) down.

WARNING

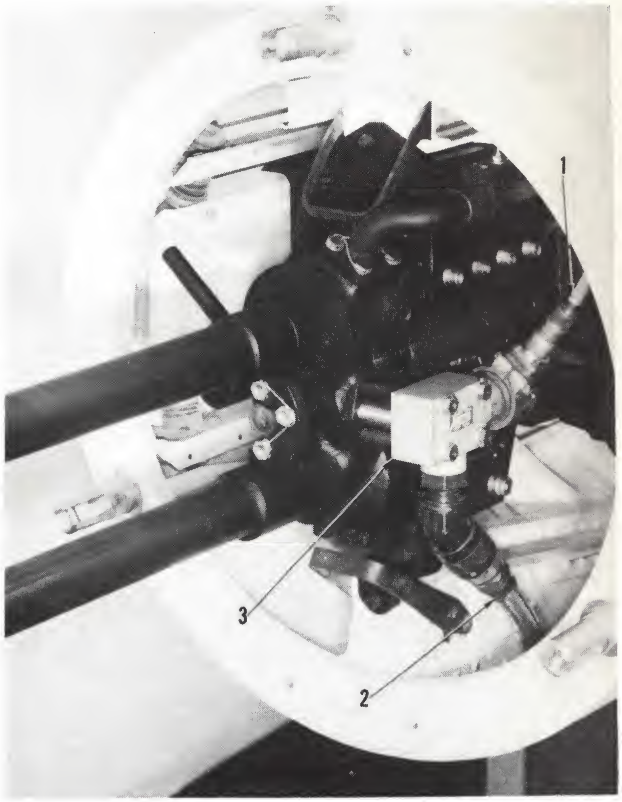
Weight of the gun mechanism is approximately 190 pounds. During removal from the pod body, the gun mechanism must be supported.

5. Pull gun mechanism (3) out of pod body. Hangers (4) will slide along guide rails (5) until gun mechanism is free of pod body.



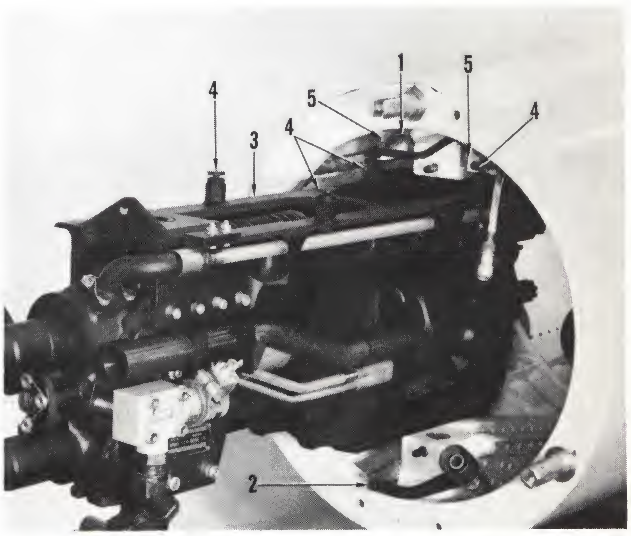
1. GUN JUNCTION BOX ELECTRICAL CABLE
2. SEQUENCING SWITCH ELECTRICAL CABLE
3. GUN JUNCTION BOX

Figure 5-19. Gun Mechanism Aft Electrical Cable Removal



1. CHARGER VALVE ELECTRICAL CABLE
2. PNEUMATIC LINE
3. CHARGER VALVE

Figure 5-20. Gun Mechanism Forward Electrical Cable Removal



1. UPPER TRUNNION LOCK
2. LOWER TRUNNION LOCK
3. GUN MECHANISM
4. HANGER
5. GUIDE RAIL

Figure 5-21. Gun Mechanism Removal

5-32. Pod Body Disassembly. The pod body disassembly consists of the removal and disassembly of the major components and subsystems of the pod body. The pod body major components and subsystems are feed system, pneumatic system, ammunition magazine and electrical system.

5-33. Feed System Removal. Remove the feed system from the pod body in accordance with the following instructions:

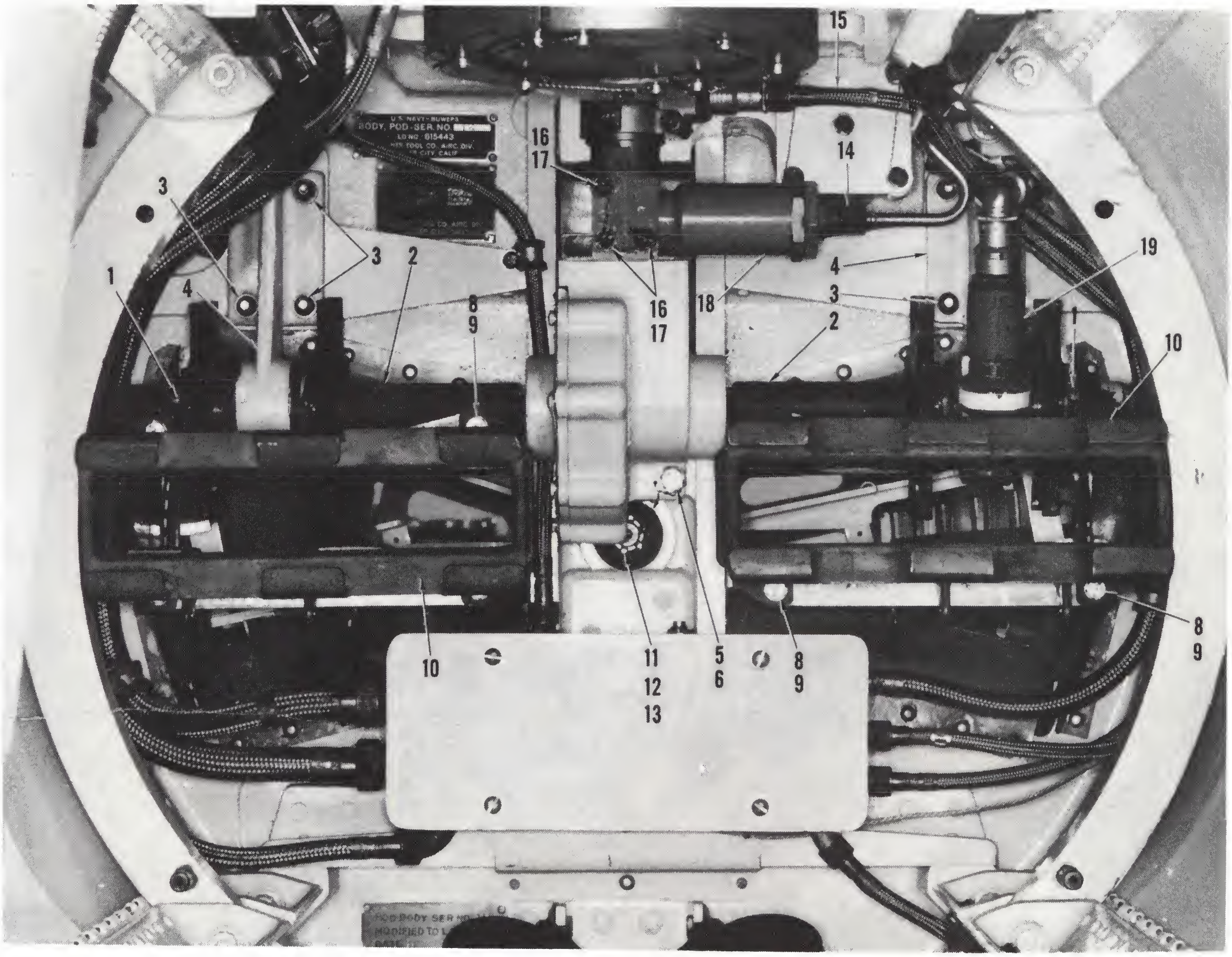
1. Remove pins (1, figure 5-22) from ammuntion drive sprocket shaft (2).

2. Pull sprocket shaft (2) out of pod body through hole in skin.

3. Remove 4 nuts (3) and associated bolts and washers on each hanger (4) and lift hangers out of pod body.

4. Disconnect pneumatic tube (14) and electrical cable (15) from ammo-drive pneumatic motor valve (18). Cut lockwire and remove bolts (16), washers (17), and ammo-drive pneumatic motor valve.

NOTE: Ammo-drive pneumatic motor valve (18) is a component of the pneumatic system. The pneumatic valve is removed as part of the feed system to simplify disassembly.



1. PIN
2. SPROCKET SHAFT
3. NUT
4. HANGER
5. BOLT
6. WASHER
7. FEED ASSEMBLY
8. BOLT
9. WASHER
10. ADAPTER ASSEMBLY
11. COTTER PIN
12. NUT
13. BUSHING
14. PNEUMATIC TUBE
15. ELECTRICAL CABLE
16. BOLT
17. WASHER
18. AMMO-DRIVE PNEUMATIC MOTOR VALVE
19. LAST ROUND SWITCH

Figure 5-22. Feed System Removal

5. Remove 3 bolts (5) and washers (6) and lift ammunition feed assembly (7) from pod body. (See figure 5-23.)

6. Remove 4 bolts (8, figure 5-22) and washers (9) from each inner throat adapter assembly (10) and remove feed throat adapters from feed throats.

7. Separate inner throat adapter (2, figure 5-24) from outer throat adapter (1).

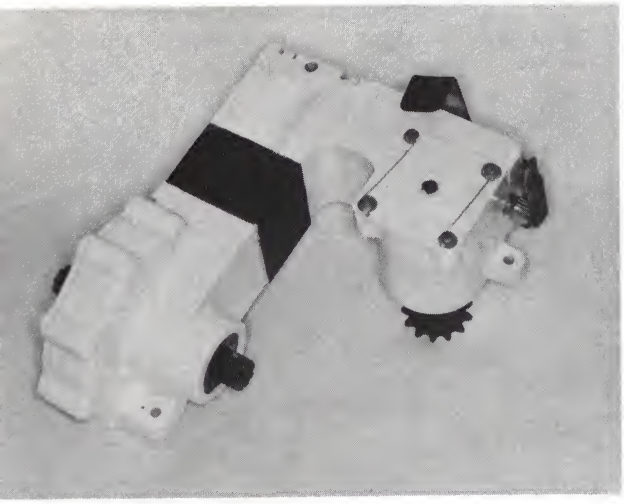
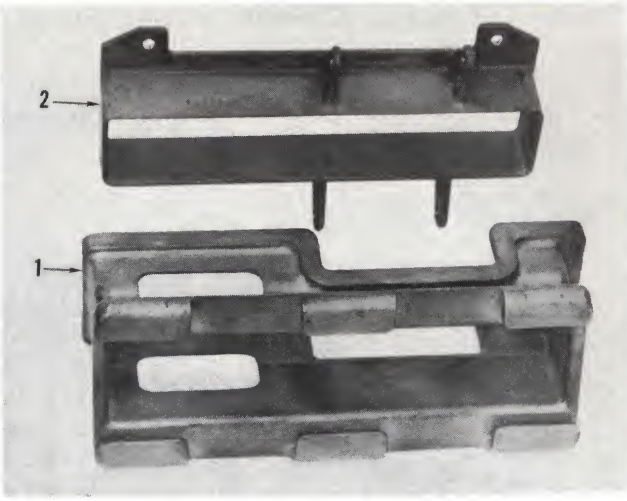


Figure 5-23. Ammunition Feed Assembly

5-34. PNEUMATIC SYSTEM DISASSEMBLY. The gun pod pneumatic system is composed of three major components (reservoir, accumulator, and valve and tray assembly) and the connecting tubing. Figure 5-25 is provided to show the relative location of the pneumatic system components. Disassembly of the pneumatic system major components is accomplished as follows:



1. OUTER THROAT ADAPTER
2. INNER THROAT ADAPTER

Figure 5-24. Throat Adapters

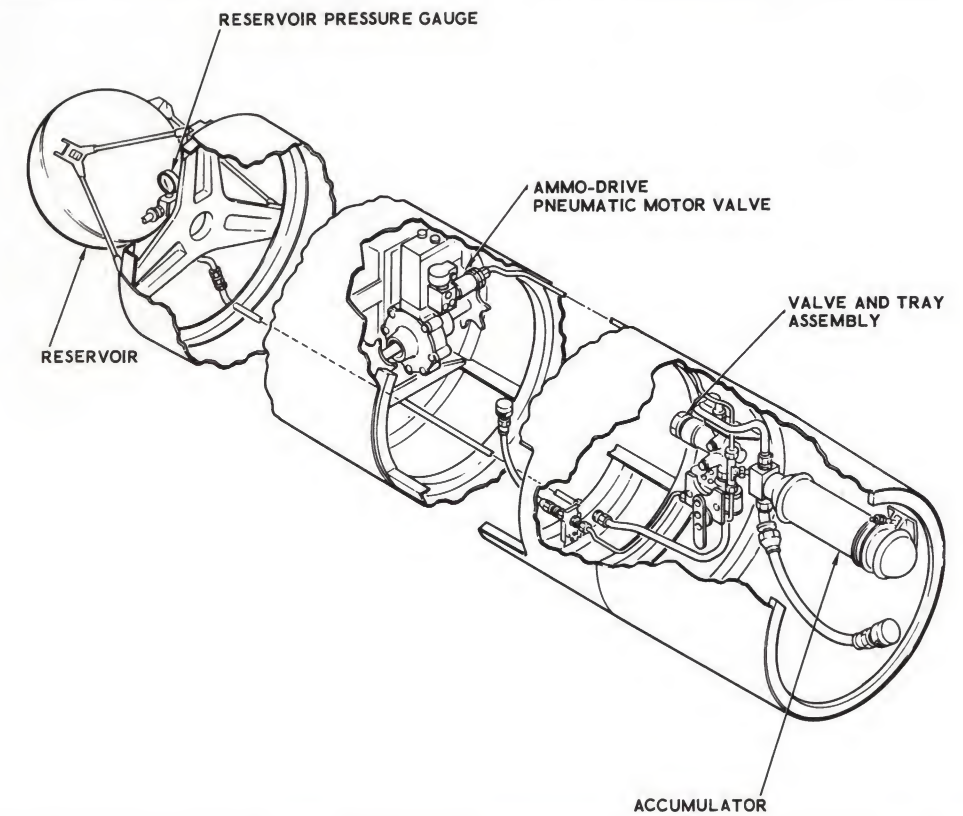


Figure 5-25. Pneumatic System Components

WARNING

Before disconnecting pneumatic tubes or removing pneumatic components, pneumatic tubes and reservoir must be bled.

1. Open pneumatic reservoir fill valve (1, figure 5-26) by removing cap and slowly rotating 3/4 inch hex nut counterclockwise. Set air valve handle (see figure 4-19) to DUMP position. Allow pneumatic pressure to gradually dissipate.

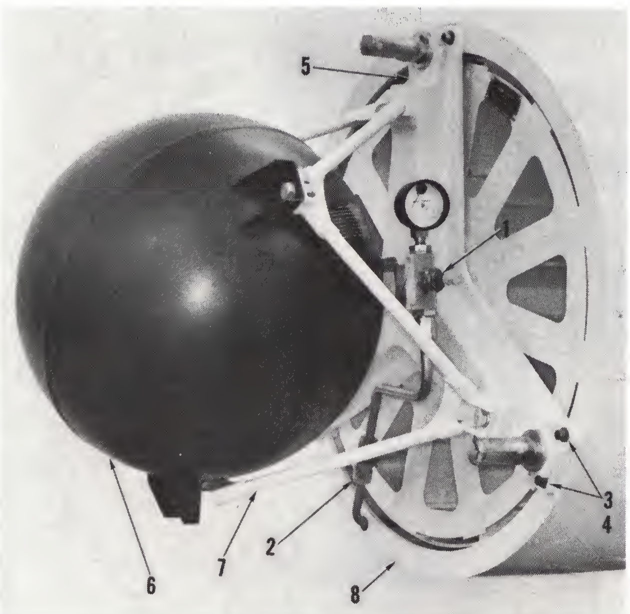
2. Disconnect fitting (2, figure 5-26).

3. Remove 6 bolts (3) and washers (4). Remove reservoir support (5), reservoir (6) and pneumatic reservoir frame (7) as a unit from pod body (8).

4. Separate reservoir (6) and pneumatic reservoir frame (7) from support (5).

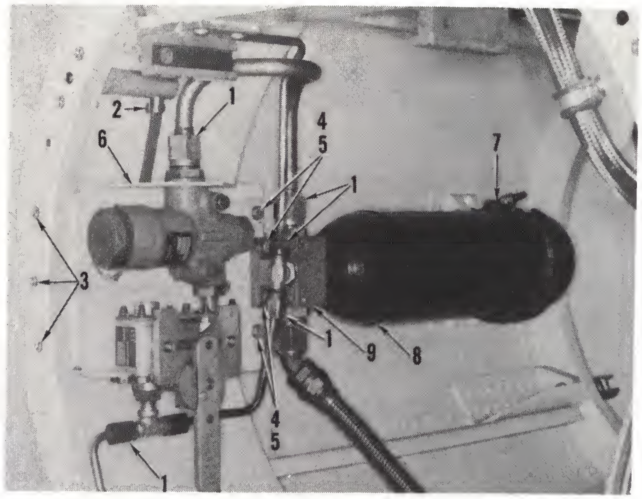
5. Disconnect fittings (1, figure 5-27), remove pin (2), 3 screws (3), 4 bolts (4) and washers (5). Lift valve and tray assembly (6) from pod body. Refer to figure 5-28 for view of valve and tray assembly after removal from pod body.

6. Remove accumulator by loosening clamp (7, figure 5-27) until accumulator (8) with manifold (9) can be pulled out of clamp.



1. FILL VALVE
2. FITTING
3. BOLT
4. WASHER
5. SUPPORT
6. RESERVOIR
7. PNEUMATIC RESERVOIR FRAME
8. POD BODY

Figure 5-26. Pneumatic Reservoir Removal



1. FITTING
2. PIN
3. SCREW
4. BOLT
5. WASHER
6. VALVE AND TRAY ASSEMBLY
7. CLAMP
8. ACCUMULATOR
9. MANIFOLD

Figure 5-27. Valve and Tray Assembly Removal

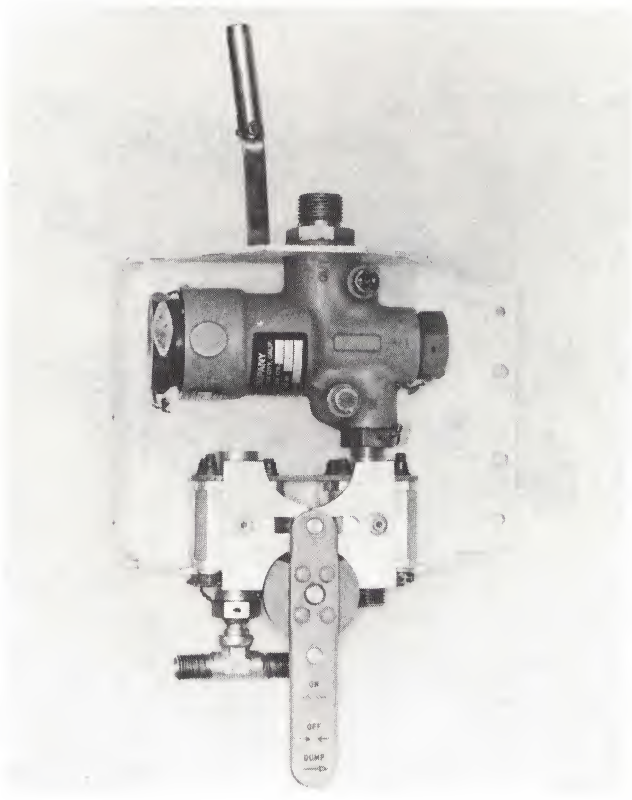


Figure 5-28. Valve and Tray Assembly

7. Remove the ammo-drive pneumatic motor valve 5, figure 5-29) from ammunition feed assembly by utting lockwire and removing 3 attachment bolts. Figure 5-23 shows ammunition feed assembly with mmo-drive pneumatic motor valve removed.

NOTE: To remove ammo-drive pneumatic motor valve when feed system is not removed from pod body, disconnect fitting (1, figure 5-29) and cable (2). Cut lockwire and remove 3 attachment bolts (3), 3 washers (4) and ammo-drive pneumatic motor valve (5).

8. Discard packing (see figure 5-30).

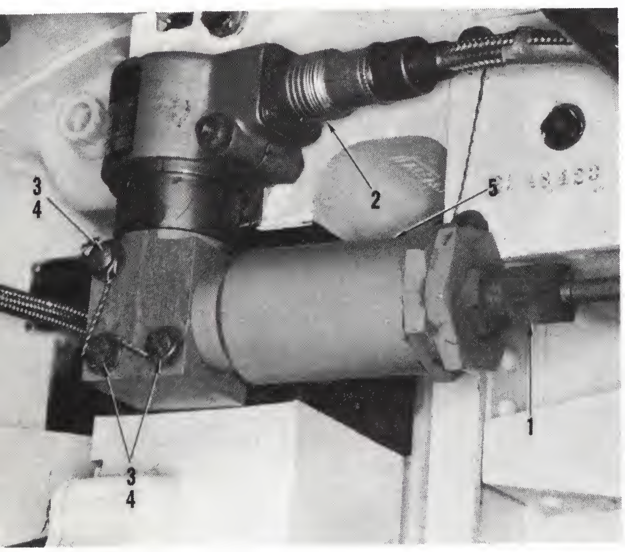
-35. AMMUNITION MAGAZINE REMOVAL. The mmunition magazine may be removed only after he pneumatic reservoir and supporting equipment ave been removed (refer to paragraph 5-33). Remove magazine in accordance with the following nstructions:

1. Remove cotter pin (11, figure 5-22), nut (12) nd bushing (13).

2. Position pneumatic tube (1, figure 5-31) so magazine (2) will clear tube as magazine is pulled out of pod body (3).

NOTE: To position pneumatic tube (1, figure 5-31) for magazine removal, it may be necessary to loosen fitting at attached end of pneumatic tube.

3. Pull magazine out of aft end of pod body.



1. FITTING
2. CABLE
3. BOLT
4. WASHER
5. AMMO-DRIVE PNEUMATIC MOTOR VALVE

Figure 5-29. Ammo-Drive Pneumatic Motor Valve Removal

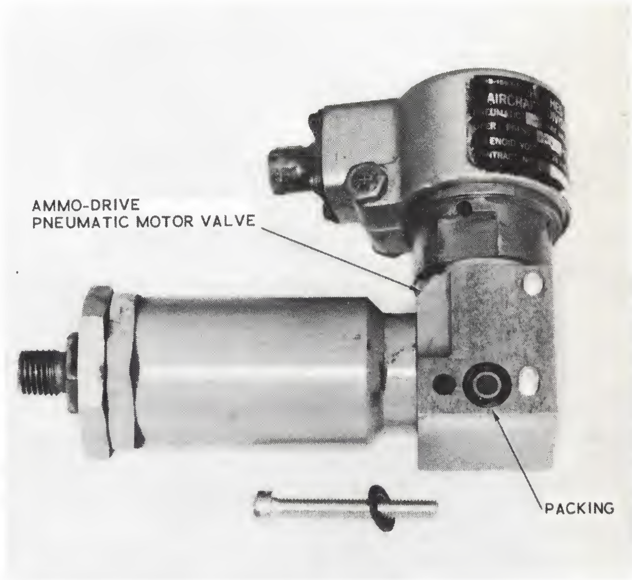
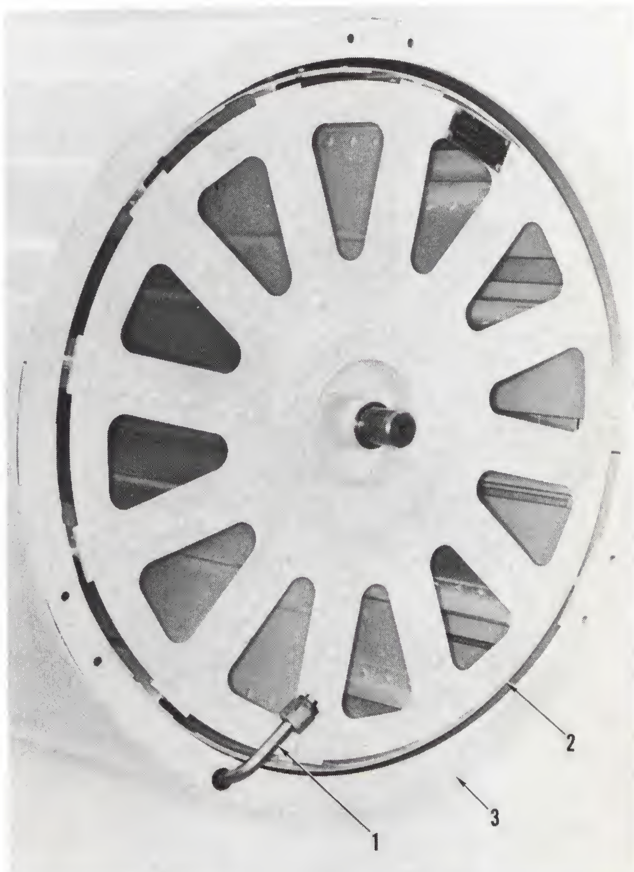


Figure 5-30. Ammo-Drive Pneumatic Motor Valve



1. PNEUMATIC TUBE
2. MAGAZINE
3. POD BODY

Figure 5-31. Ammunition Magazine Removal

5-36. ELECTRICAL SYSTEM DISASSEMBLY. The gun pod electrical system is composed of two major components (control box and pod junction box), cables and associated connectors. Figure 5-32 is provided to show the relative location of the electrical system components and cable connecting points. Other than standard replacement of damaged or worn cable assemblies, disassembly of the electrical system is confined to removal and replacement of the control box (1, figure 5-8). The pod junction box cover (3, figure 5-33) may require removal for inspection purposes. Removal and replacement of electrical component is accomplished as follows:

1. Disconnect all electrical cable connections to control box (1, figure 5-8). Disconnect cables routed to gun mechanism at gun junction box. Disconnect cables between pod junction box and pod control box at pod control box end.

2. Remove 4 bolts (2), washers (3) and shield (4).

3. Remove 6 bolts (5), washers (6) and control box (1).

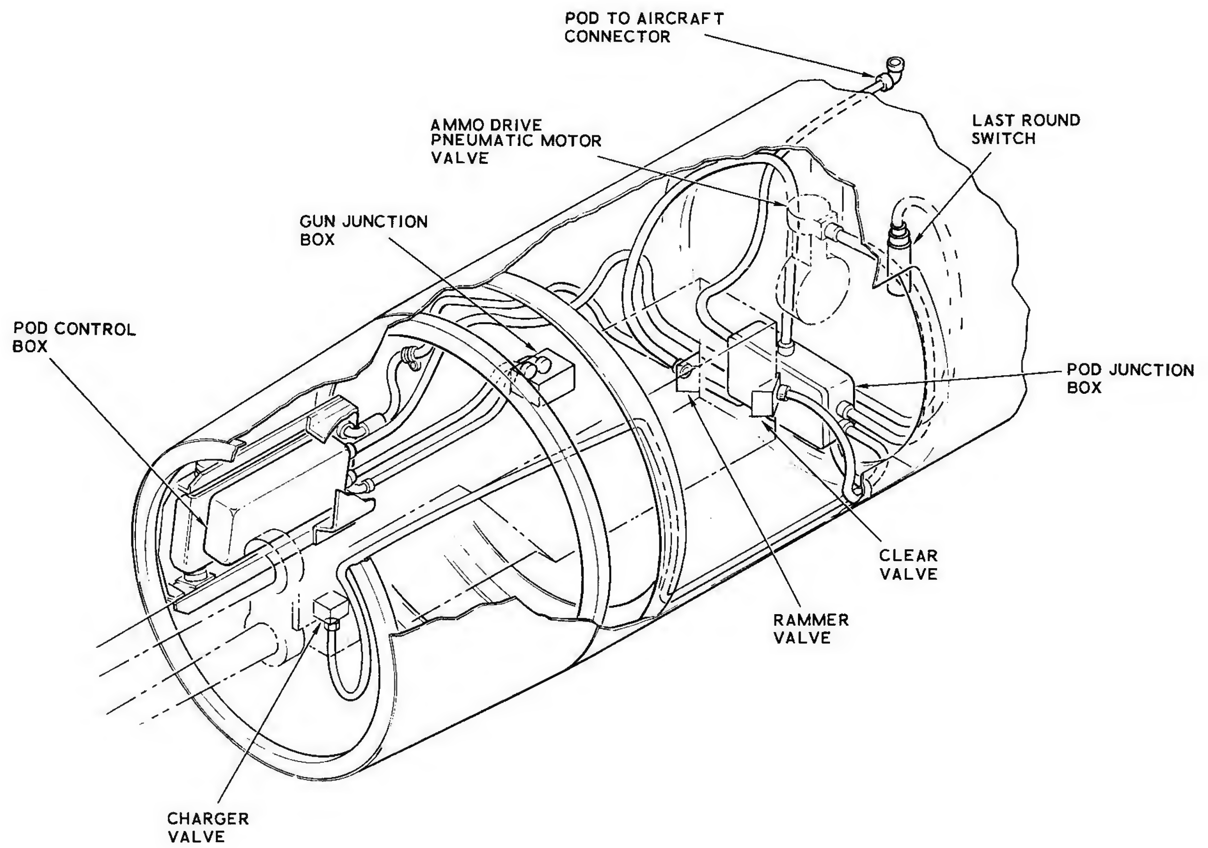


Figure 5-32. Electrical System Components

4. Remove 4 screws (1, figure 5-33), washers (2) and pod junction box cover (3).

5-37. GUN MECHANISM DISASSEMBLY. Position the Mk 11 gun (see figure 2-3) so Mk 11 gun rests on the four hangers, and disassemble Mk 11 gun, observing the following instructions:

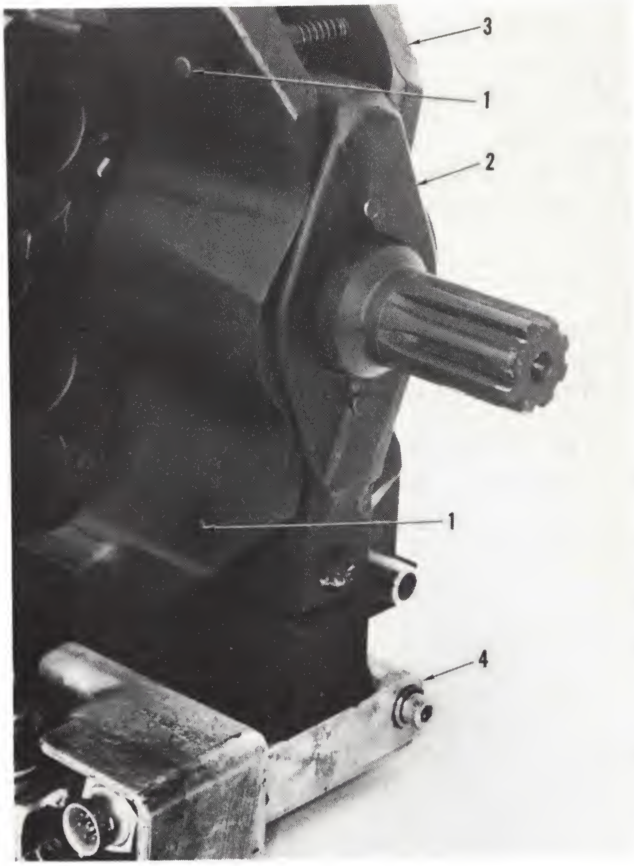
1. Depress firing pin latches (1, figure 5-34) and remove firing pin holder assembly (2) from breech (3).

2. Rotate sleeve assembly insulator (1, figure 5-35) 90 degrees and remove insulator (1), firing pin (2) and spring (3) as a unit from firing pin holder (4). Separate insulator, firing pin and spring.

3. Depress spring (1, figure 5-36), swing arm (2) open and pull sequencing switch (3) out of switch retainers. Rod end on switch will slip off pin on side of breech.

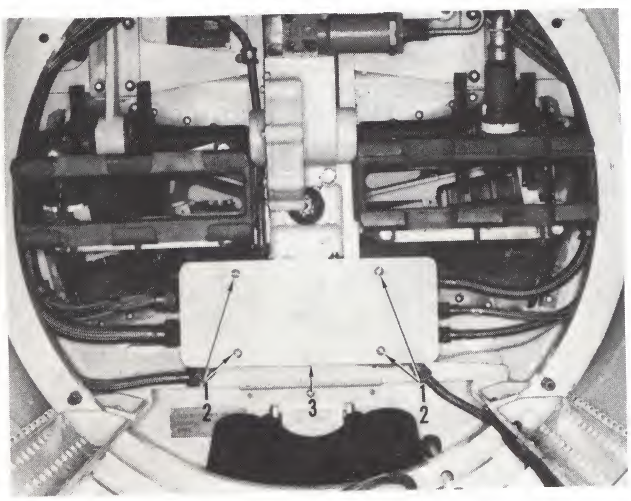
4. Remove bolts (1, figure 5-37) and washers (2) from gun junction box (3). Remove the gun junction box with sequencing switch attached (see figure 5-38) as a unit. Remove nut and washer (see figure 5-38) to separate sequencing switch from gun junction box.

5. Remove bolt (1, figure 5-39), washer (2) and self locking nut (3). While sliding right hand air tube assembly (4) aft, rotate tube assembly 90 degrees (see figure 5-40). Pull tube assembly forward and remove from gun mechanism.



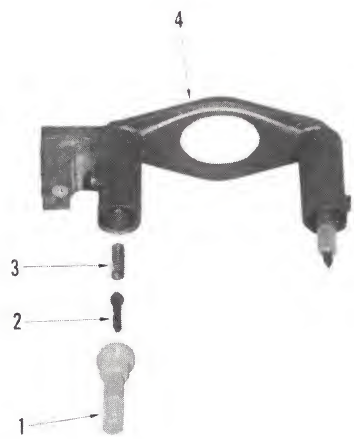
1. LATCH
2. FIRING PIN HOLDER ASSEMBLY
3. BREECH
4. GUN JUNCTION BOX

Figure 5-34. Firing Pin Mechanism Removal



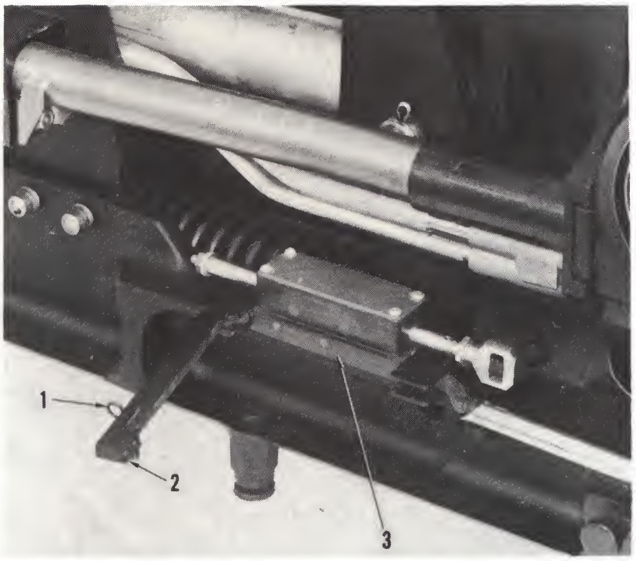
1. SCREW
2. WASHER
3. COVER

Figure 5-33. Pod Junction Box Cover Removal



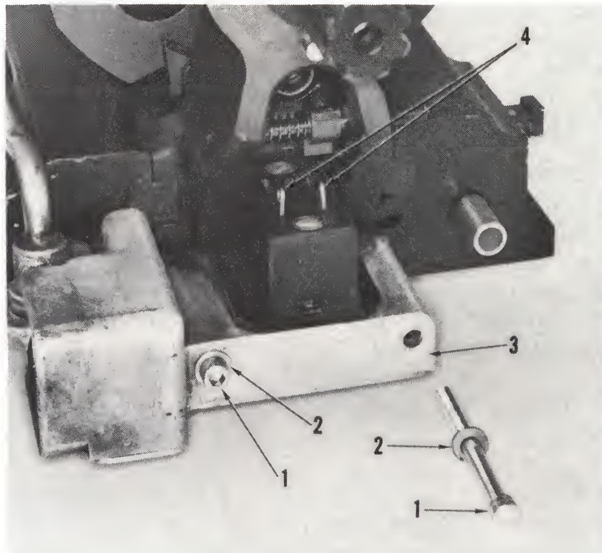
1. INSULATOR
2. FIRING PIN
3. SPRING
4. FIRING PIN HOLDER

Figure 5-35. Firing Pin Holder Assembly



1. SPRING
2. ARM
3. SEQUENCING SWITCH ASSEMBLY

Figure 5-36. Gun Sequencing Switch Removal



1. BOLT
2. WASHER
3. GUN JUNCTION BOX
4. SPRING

Figure 5-37. Gun Junction Box Removal

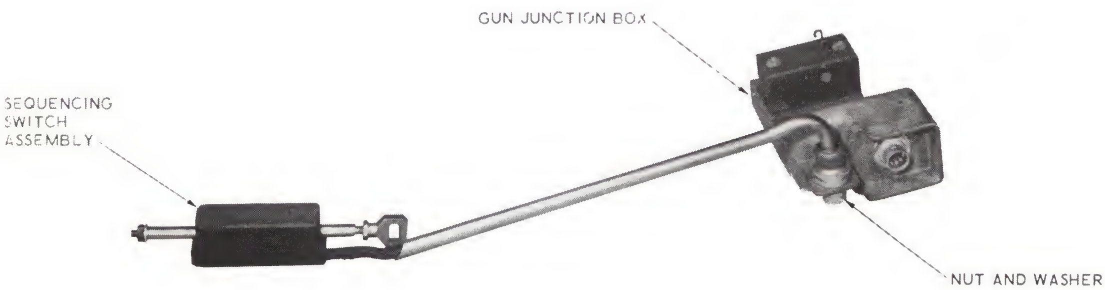
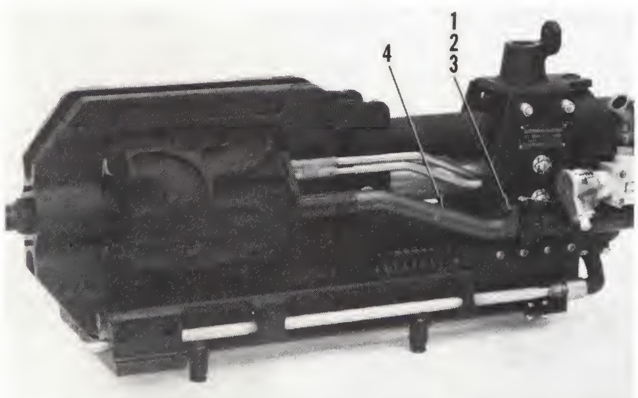


Figure 5-38. Gun Junction Box and Sequencing Switch



1. BOLT
2. WASHER
3. NUT
4. RIGHT HAND AIR TUBE ASSEMBLY

Figure 5-39. Right Hand Air Tube Assembly Attaching Parts

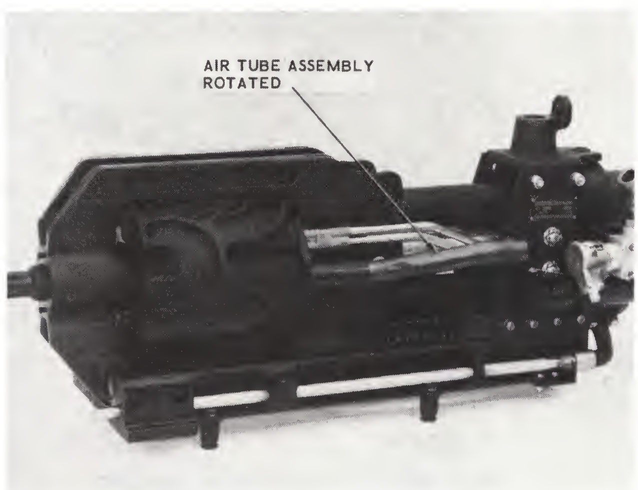


Figure 5-40. Air Tube Assembly Removal

6. Position pin (1, figure 5-41) by removing attaching cotter pin (2), washer (3) and sliding pin (1) out until revolver cylinder shaft (4) is free to be pulled from revolver cylinder (5). Remove revolver cylinder shaft and push pin (1) back in place.

7. Remove revolver cylinder by rolling revolver cylinder out of breech.

8. Remove round positioner assembly (1, figure 5-42), outer extractors (2), ring seal retainer assembly (3) with gas eject tube support (4), and air tube support (5) as a unit.

NOTE: See figure 5-43 for extractor identification.

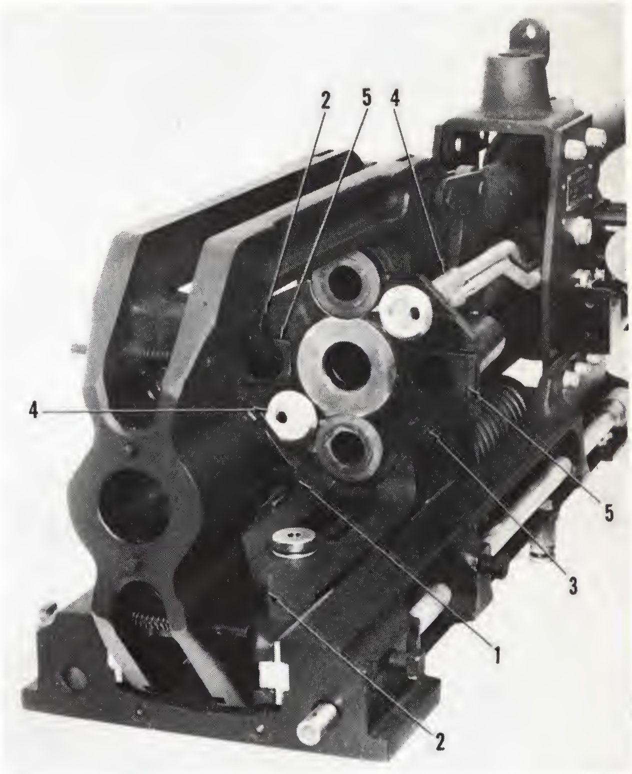
9. Remove spring (1, figure 5-44), latches (2) and retainers (3) from round positioner (4).

10. Separate air and gas ejection tube support (1, figure 5-45) and air tube support (2) from ring seal retainer assembly (3).

11. Remove 8 ring seals (1, figure 5-46) from revolver cylinder (4) using special ring seal removal tool (see figure 5-7).

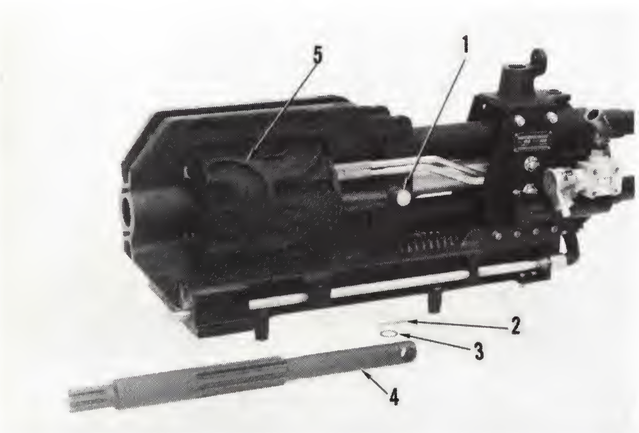
NOTE: Do not remove ring seal seat (2) or rifled insert (3). Removal of ring seal seat requires special overhaul tools and is described in Volume 3, Overhaul Procedures.

12. Cut lockwire and loosen bolts (1, figure 5-47) which attach charger valve (2) to booster housing (3). Remove charger valve and attached parts as a unit.



1. ROUND POSITIONER ASSEMBLY
2. OUTER EXTRACTOR
3. RING SEAL RETAINER ASSEMBLY
4. AIR AND GAS EJECT TUBE SUPPORT
5. AIR TUBE SUPPORT

Figure 5-42. Detail Components in Breech Area

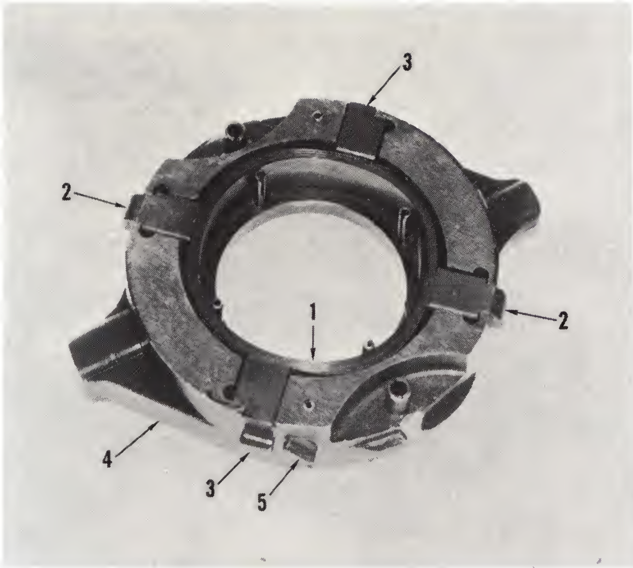


1. REMOVAL PIN
2. COTTER PIN
3. WASHER
4. REVOLVER CYLINDER SHAFT
5. REVOLVER CYLINDER ASSEMBLY

Figure 5-41. Revolver Cylinder Assembly

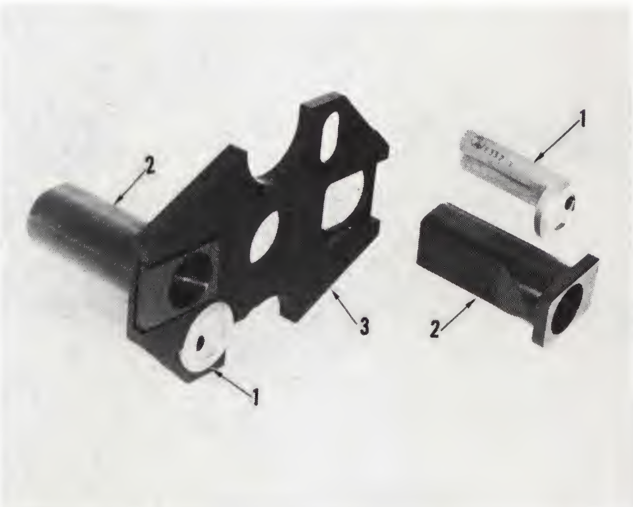


Figure 5-43. Outer Extractors



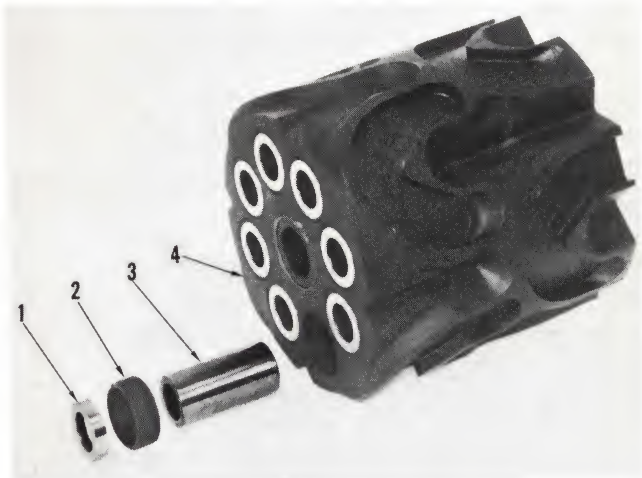
1. ROUND POSITIONER SPRING
2. LATCH
3. RETAINER
4. ROUND POSITIONER
5. INNER EXTRACTOR

Figure 5-44. Round Positioner Assembly



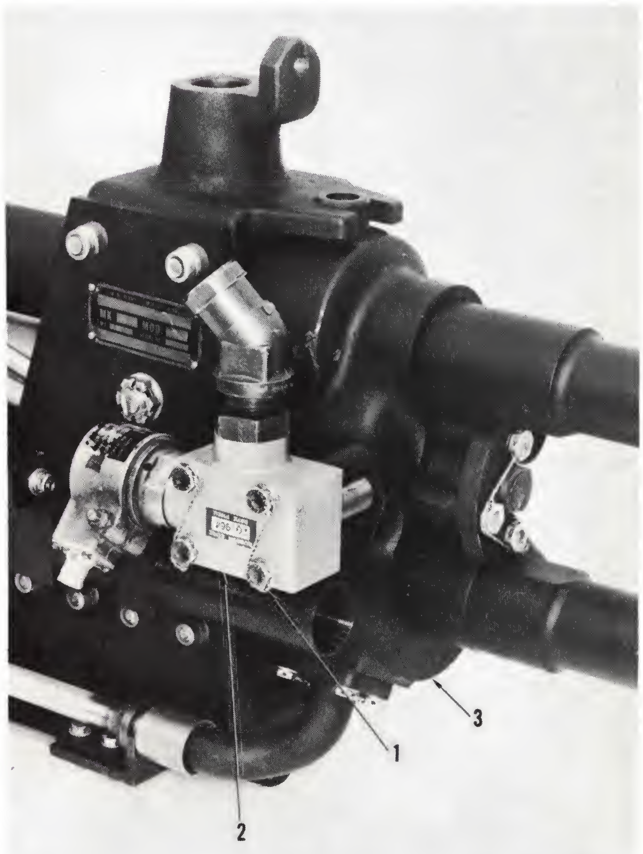
1. AIR AND GAS EJECT TUBE SUPPORT
2. AIR TUBE SUPPORT
3. RING SEAL RETAINER ASSEMBLY

Figure 5-45. Ring Seal Retainer Assembly and Tube Supports



1. RING SEAL
2. RING SEAL SEAT
3. RIFLED INSERT
4. REVOLVER CYLINDER

Figure 5-46. Revolver Cylinder Assembly and Ring Seal



1. BOLT
2. CHARGER VALVE
3. BOOSTER HOUSING

Figure 5-47. Charger Valve Removal

13. Separate bolts (1, figure 5-48), washers (2), spacers (3), coupling half (4) and standoff (5) from charger valve (6).

14. Remove left hand tube assembly (1, figure 5-49) by removing attaching bolt (2), washer (3) and nut (4).

15. Depress push button (5) and rotate locking lever (6) to REL (unlocked) position.

16. Slide booster housing (1, figure 5-50) with attached parts out of receiver assembly (2) and off gun barrels (3 and 4).

17. Cut safety wire and loosen 3 bolts (1, figure 5-51) until barrel lock (3) can be removed. Remove barrel lock (3), lock spacers (2) and bolts (1) as a unit. Separate lock spacers and bolts.

18. Remove adjusting nut (4), locking lever (5) and push lock bolt (6) out of booster housing (11). Remove elbow (10) by removing 4 attaching bolts and washers.

WARNING

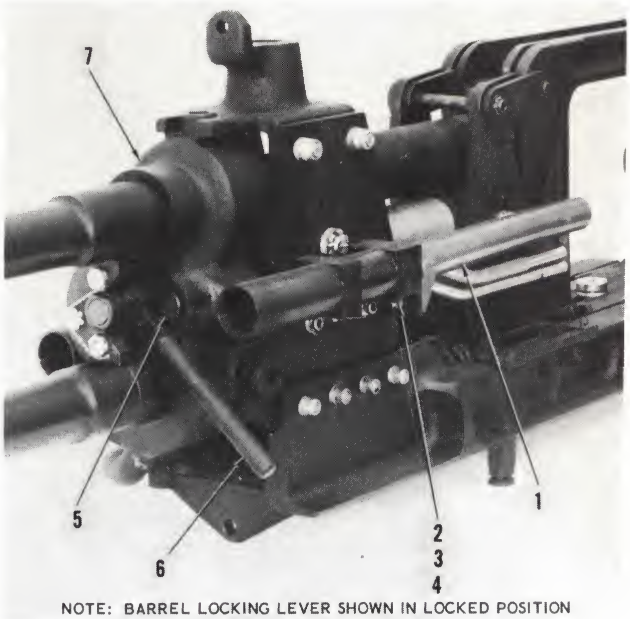
Push button (8) is spring loaded. Maintain pressure on push button while removing spring pin (7).

19. Drive spring pin (7) out of push button (8). Remove push button (8) and spring (9).

20. Rotate barrels until the barrels are free from the breech assembly and pull barrels from the receiver assembly. Inspect barrel and barrel inserts in accordance with instructions in table 5-4.

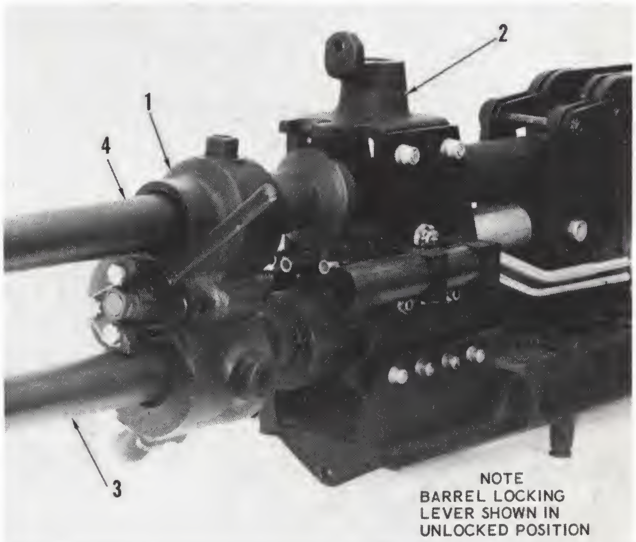
NOTE: Do not remove inserts (1, figure 5-52) from barrels (2 and 3) unless replacement is necessary. Removal of barrel inserts may require use of special barrel insert removal tool (refer to table 5-1).

21. Position the yoke and slider (see figure 5-53) so the slider shaft (2) which attaches the yoke (1) to the slider is aligned with the hole in the receiver assembly. The hold forward assembly (see figure 5-54) will drop from the receiver assembly. Drive slider shaft out.



1. LEFT HAND TUBE ASSEMBLY
2. BOLT
3. WASHER
4. NUT
5. PUSH BUTTON
6. LOCKING LEVER
7. BOOSTER HOUSING

Figure 5-49. Preparation for Recoil Booster Assembly Removal



1. BOOSTER HOUSING
2. RECEIVER ASSEMBLY
3. FIRST ROUND BARREL
4. LAST ROUND BARREL

Figure 5-50. Recoil Booster Assembly and Barrel Removal

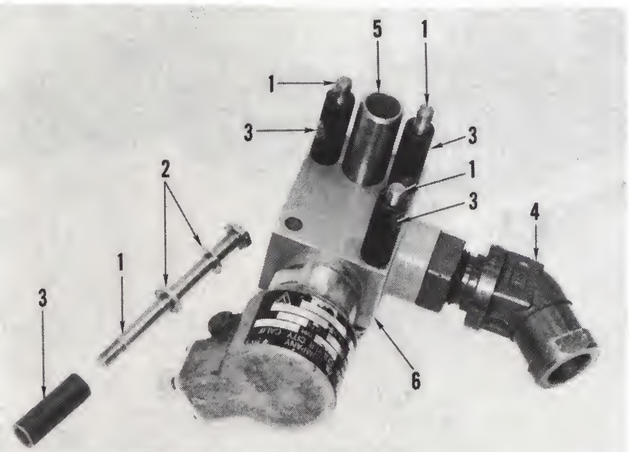


Figure 5-48. Charger Valve

Key To Figure 5-48

1. Bolt
2. Washer
3. Spacer
4. Coupling Half
5. Standoff
6. Charger Valve

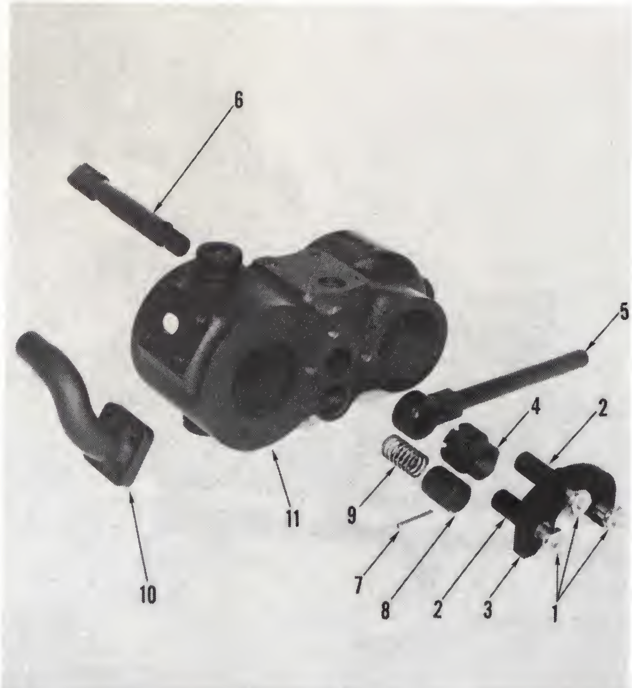


Figure 5-51. Recoil Booster Assembly Exploded View

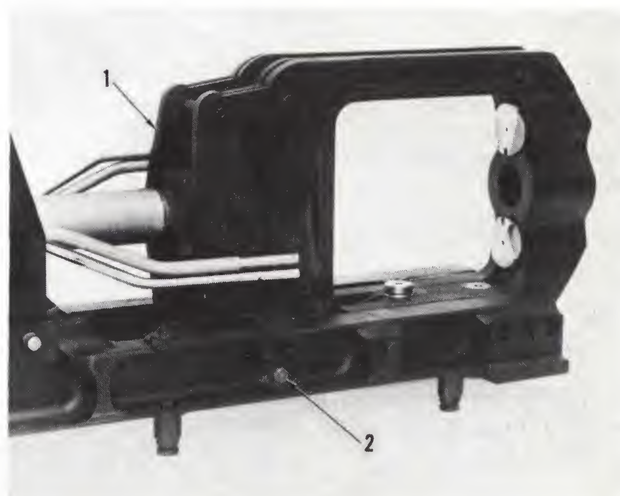
Key To Figure 5-51

1. Bolt
2. Lock Spacer
3. Barrel Lock
4. Adjusting Nut
5. Locking Lever
6. Lock Bolt
7. Spring Pin
8. Push Button
9. Spring
10. Gas Elbow
11. Booster Housing



1. BARREL INSERT
2. FIRST ROUND BARREL
3. LAST ROUND BARREL

Figure 5-52. Gun Barrels and Barrel Inserts



1. YOKE 2. SLIDER SHAFT

Figure 5-53. Hold Forward Assembly Removal

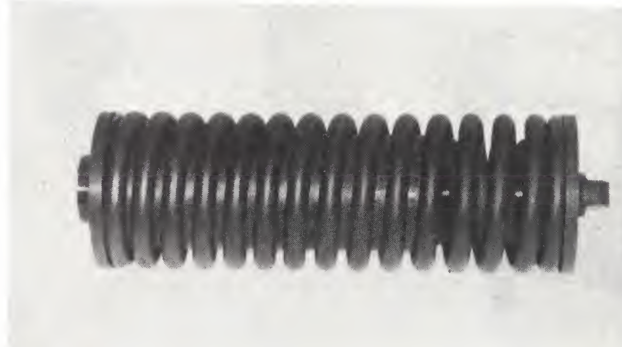


Figure 5-54. Hold Forward Assembly

22. Slide breech assembly (1, figure 5-55) from the receiver assembly (2).

23. Remove air tube bracket (1, figure 5-56) by cutting lock wire and removing screw (2) and washers (3).

24. Remove bolts (4), cotter pins (5), washers (6) and nuts (7). Pull counter recoil damper assembly (8) and eject tubes out of receiver assembly (9). Separate counter recoil damper assembly (3, figure 5-57) and eject tubes (1 and 2).

25. Remove gun gas tube (10, figure 5-56) by removing bolts (11), washers (12), and nuts (13), and sliding gun gas tube out of receiver.

26. Depress forward cam follower (1, figure 5-58) by aligning forward cam follower with forward cut-out in cam follower lock key (2). Raise slider link (3) and push slider housing (4) aft until forward cam follower is aligned with aft cut-out in cam follower lock key.

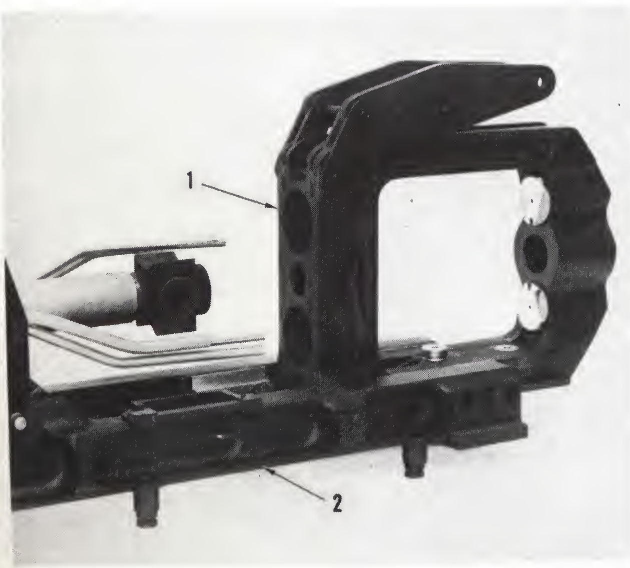
27. Depress aft cam follower (1, figure 5-59) and push slider housing (2) out of breech assembly (3).

28. Remove shift lever pin (5, figure 5-60) and follower shift lever (6).

29. Push cam followers (1, figure 5-60) out of slider housing (2).

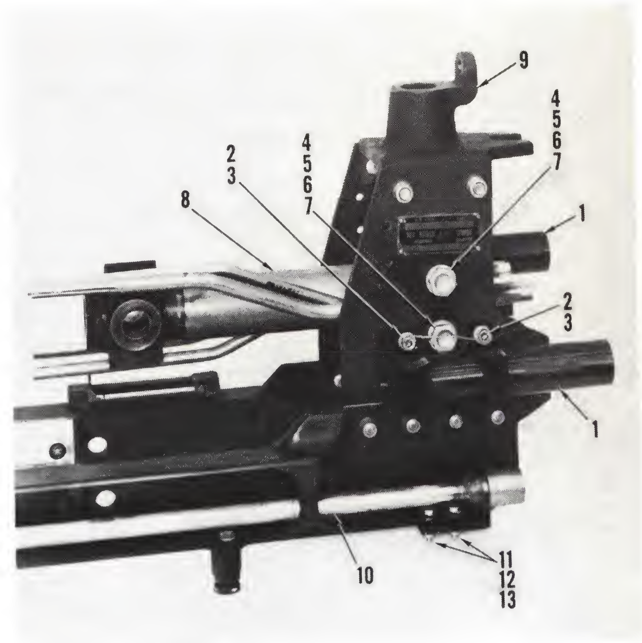
30. Remove aft slider pin (3) and slider link (4).

NOTE: Do not remove drive spring pins (3) from breech assembly unless replacement is necessary.



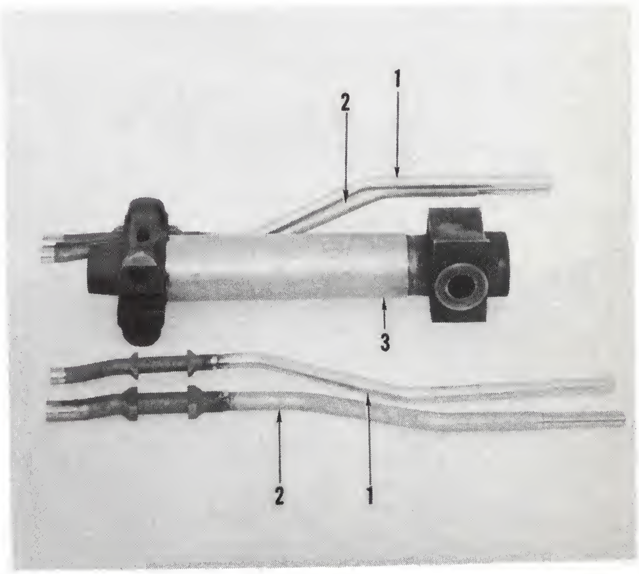
1. BREECH ASSEMBLY
2. RECEIVER ASSEMBLY

Figure 5-55. Breech Assembly Removal



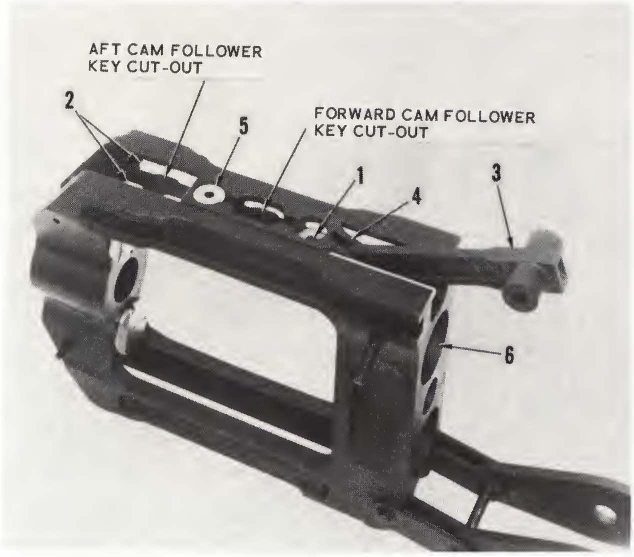
1. AIR TUBE BRACKET
2. SCREW
3. WASHER
4. BOLT
5. COTTER PIN
6. WASHER
7. NUT
8. COUNTER RECOIL DAMPER ASSEMBLY
9. RECEIVER ASSEMBLY
10. GUN GAS TUBE
11. BOLT
12. WASHER
13. NUT

Figure 5-56. Counter Recoil Damper Assembly Removal



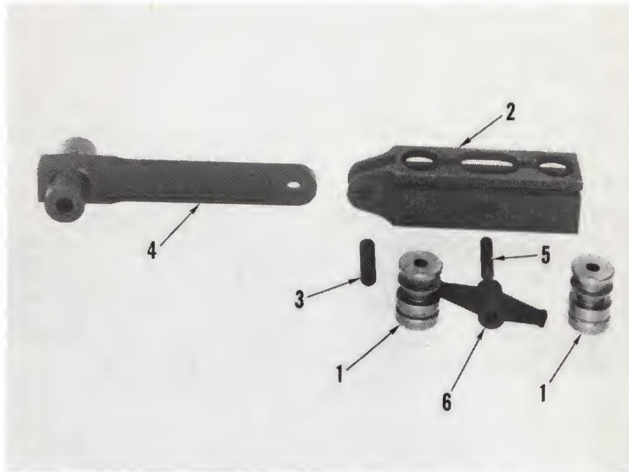
1. AIR EJECT TUBE
2. GAS EJECT TUBE
3. COUNTER RECOIL DAMPER ASSEMBLY

Figure 5-57. Counter Recoil Damper Assembly



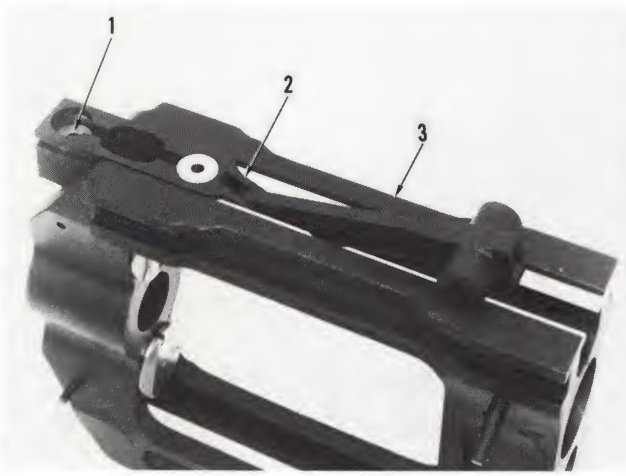
1. FORWARD CAM FOLLOWER
2. CAM FOLLOWER LOCK KEY
3. SLIDER LINK
4. SLIDER HOUSING
5. AFT CAM FOLLOWER
6. BREECH ASSEMBLY

Figure 5-58. Preparation for Slider Assembly Removal



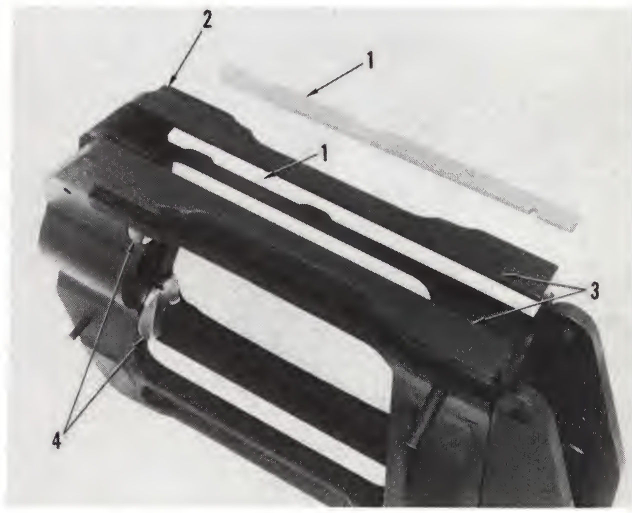
1. CAM FOLLOWER
2. SLIDER HOUSING
3. AFT SLIDER PIN
4. SLIDER LINK
5. SHIFT LEVER PIN
6. FOLLOWER SHIFT LEVER

Figure 5-60. Slider Assembly



1. AFT CAM FOLLOWER
2. SLIDER HOUSING
3. BREECH ASSEMBLY

Figure 5-59. Slider Assembly Removal



1. CAM FOLLOWER LOCK KEY
2. BREECH ASSEMBLY
3. SPRING PIN
4. ANVIL

Figure 5-61. Cam Follower Lock Key Removal

32. Remove anvils (4) from breech assembly by removing anvil nuts (1, figure 5-62) and pulling anvils (2) from breech assembly.

33. Remove firing pin latches (5, figure 5-63) from breech by driving out roll pins and sliding latch components out of breech.

NOTE: Do not remove yoke (1, figure 5-63) from breech assembly (3) or bearing inserts (1, figure 5-64) from receiver (2) unless replacement is necessary.

5-38. LOADER DISASSEMBLY. Disassemble the loader (see figure 2-5), observing the following instructions:

1. Remove retainer ring (1, figure 5-65) from front sprocket (2) and remove front sprocket.

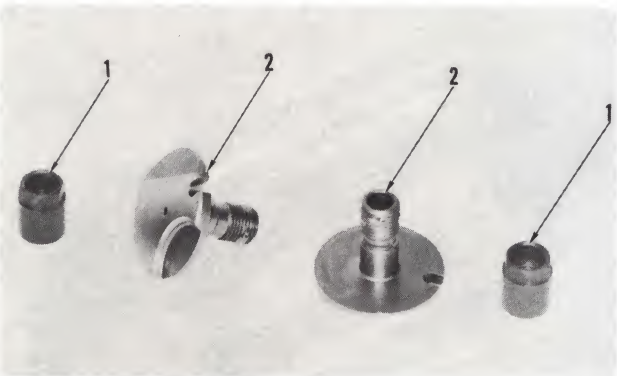
2. Remove 8 bolts (1, figure 5-66) and washers (2).

3. Cut lock wire and remove 4 bolts (3) and washers (4).

4. Slide ramming mechanism out of loader frame and off loader gas tube (see figure 5-67).

5. Attach special ramming mechanism holding fixture (see figure 5-1) to ramming mechanism (see figure 5-68).

6. Position ramming mechanism in vise as shown in figure 5-69 and disconnect pneumatic tubes (1) from check valve (2). Loosen fitting (3) and remove pneumatic tubes.



1. ANVIL NUT
2. NUT

Figure 5-62. Anvils and Anvil Nuts

Key To Figure 5-64

1. Bearing Insert
2. Receiver Assembly
3. Forward Loader Attaching Stud
4. Aft Loader Attaching Stud



1. YOKE
2. YOKE SHAFT
3. BREECH ASSEMBLY
4. SHAFT
5. LATCH
6. SPRING

Figure 5-63. Breech Assembly Firing Pin Latches and Yoke

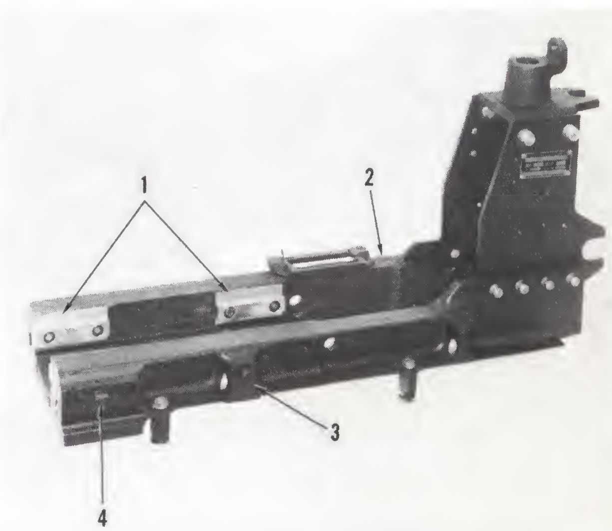
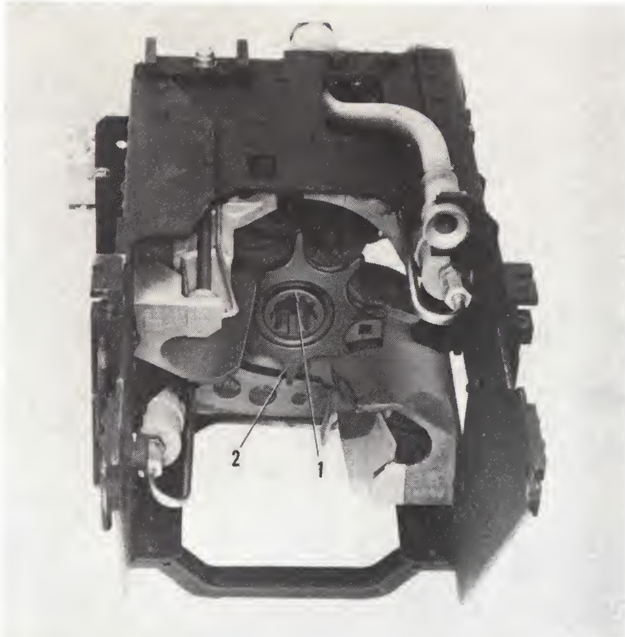


Figure 5-64. Receiver Assembly



1. RING 2. FRONT SPROCKET

Figure 5-65. Loader Front Sprocket Ring Removal

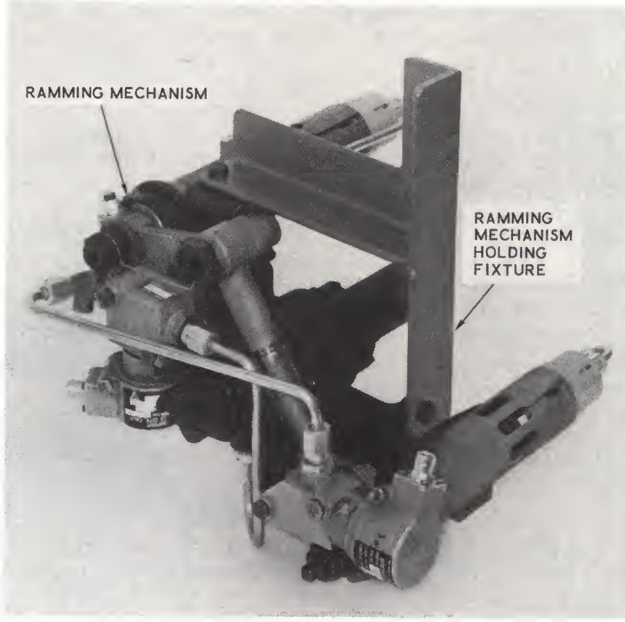


Figure 5-68. Preparation for Ramming Mechanism Disassembly

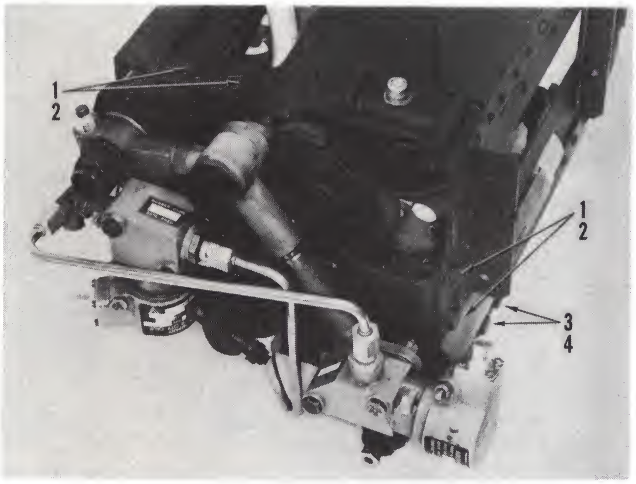


Figure 5-66. Ramming Mechanism and Attached Parts Removal

Key To Figure 5-66

1. Bolt
2. Washer
3. Bolt
4. Washer

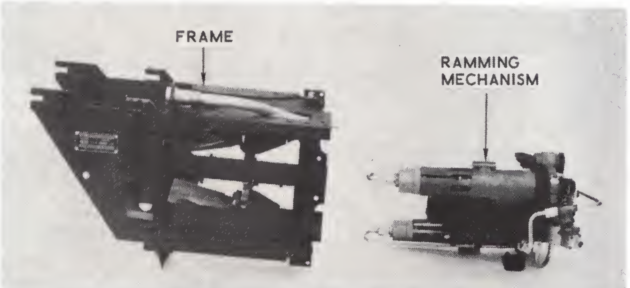
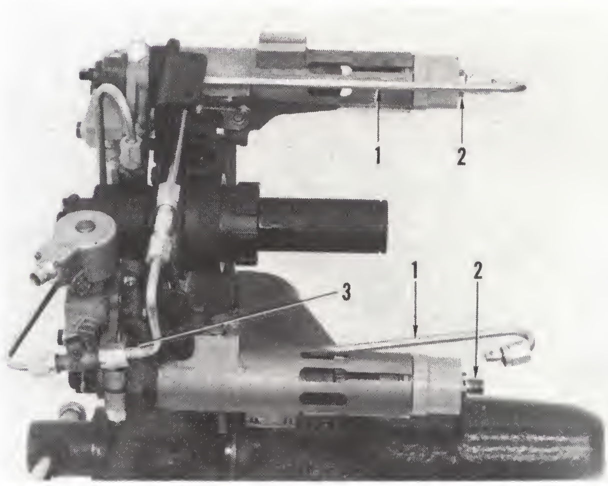


Figure 5-67. Loader Frame and Ramming Mechanism With Attached Parts



1. PNEUMATIC TUBE
2. CHECK VALVE
3. FITTING

Figure 5-69. Disconnecting Check Valve Pneumatic Tubes

7. Rotate check valve (2, figure 5-69) until slot in buffer retainer (1, figure 5-70) is aligned with slot in rammer housing (2).

8. Position screw driver in rammer housing slot so screw driver tip prevents buffer ring from rotating when check valve is removed (see figure 5-71). Remove check valves (2, figure 5-69).

9. Insert screw driver in slot in rammer housing vanes and pry vanes open wide enough for buffer assemblies to be removed (see figure 5-72). Remove buffer assemblies and separate parts (see figure 5-73).

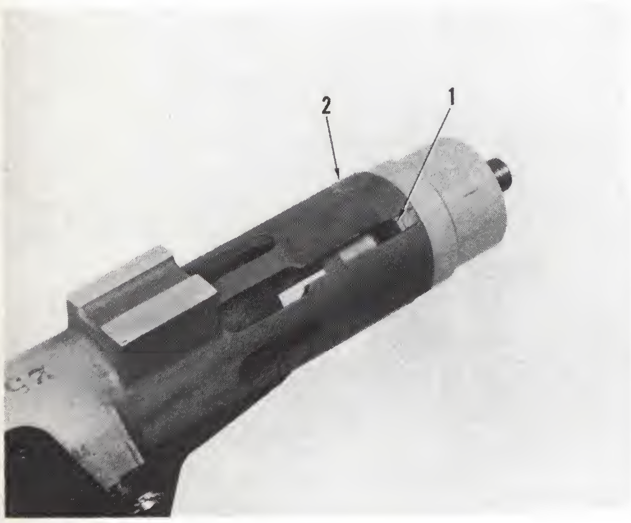
10. Remove all tubings and fittings (see figure 5-74) from ramming mechanism.

11. Remove bolts (1, figure 5-74), washers (2), rammer valve (3), bolts (4), washers (5) and declutch valve (6).

12. Remove heat barrier check valve (1, figure 5-75), gasket (2), nut (3) with guide and poppet (see figure 5-76).

13. Remove bolt (1, figure 5-77), washer (2), nuts (3), retainers (4) and washer seals (see figure 5-78).

NOTE: Do not separate retainer and washer unless washer requires replacement.



1. BUFFER RETAINER

2. RAMMER HOUSING

Figure 5-70. Preparation for Buffer Assembly Removal

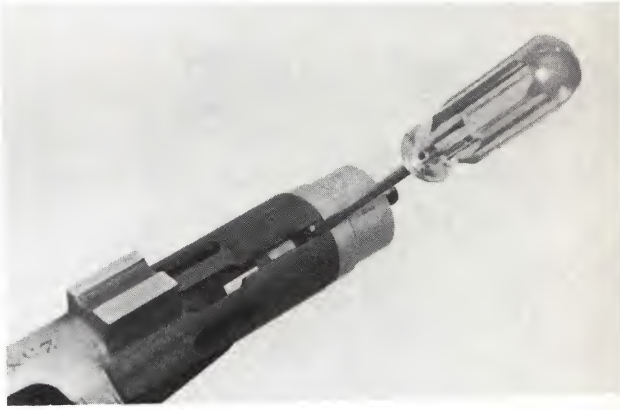


Figure 5-71. Check Valve Removal

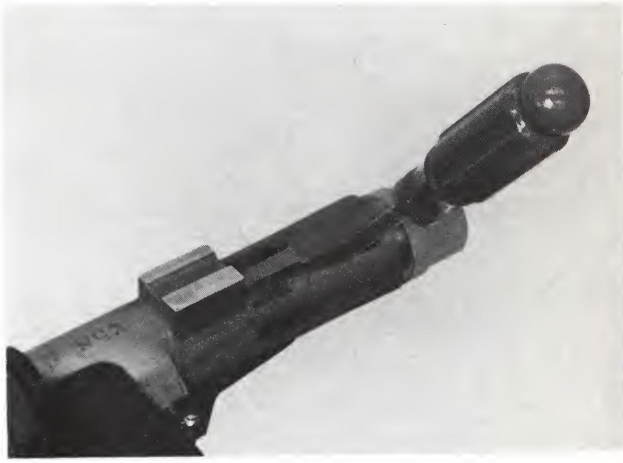
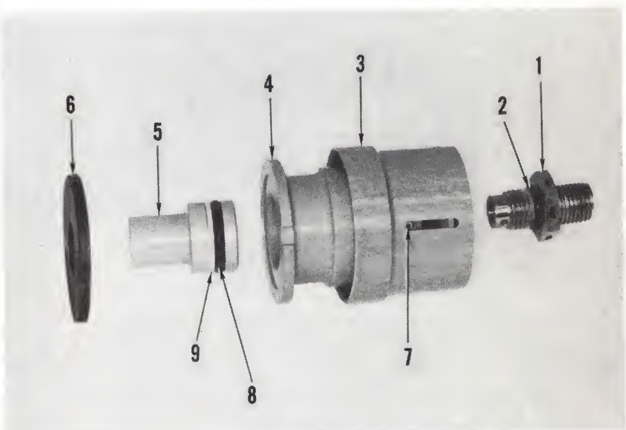
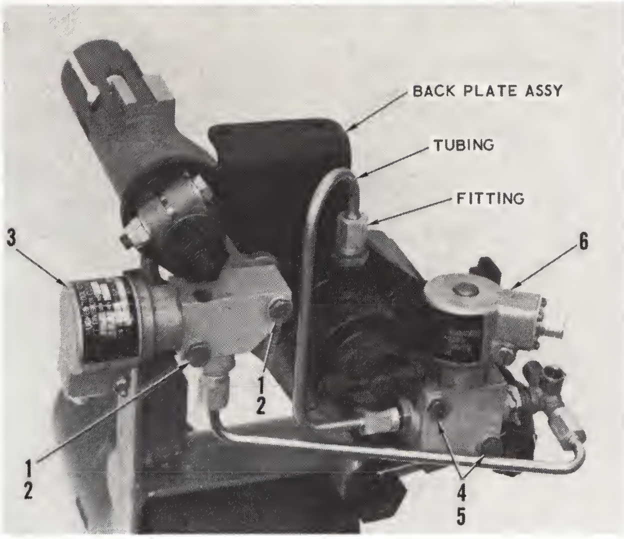


Figure 5-72. Buffer Assembly Removal



1. CHECK VALVE
2. GASKET
3. COLLAR
4. RETAINER
5. PISTON
6. WASHER
7. PIN
8. PACKING
9. RETAINER

Figure 5-73. Buffer Assembly



1. BOLT
2. WASHER
3. RAMMER VALVE
4. BOLT
5. WASHER
6. DECLUTCH VALVE

Figure 5-74. Ramming Mechanism Pneumatic Components Removal

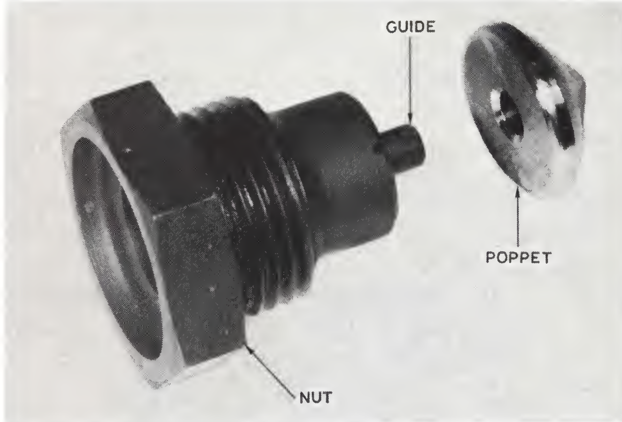


Figure 5-76. Guide and Poppet

Key To Figure 5-77

1. Bolt
2. Washer
3. Nut
4. Retainer
5. Bolt
6. Washer
7. Nut
8. Manifold Valve Body Casting
9. Manifold Terminal

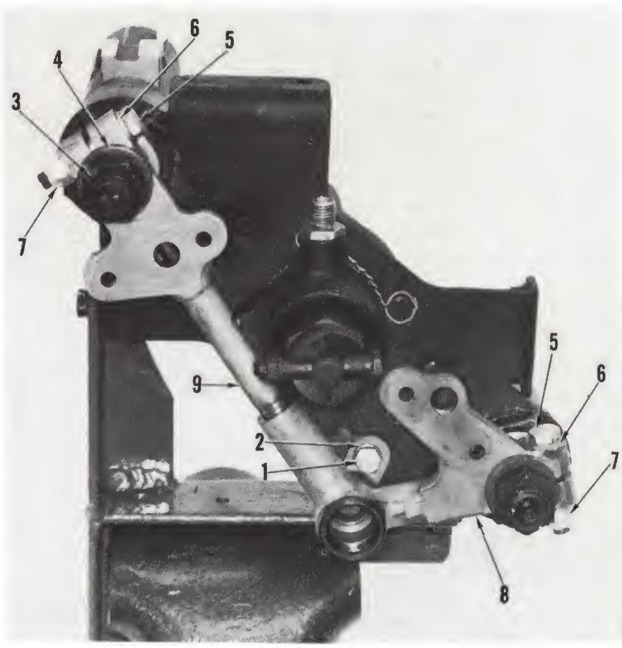
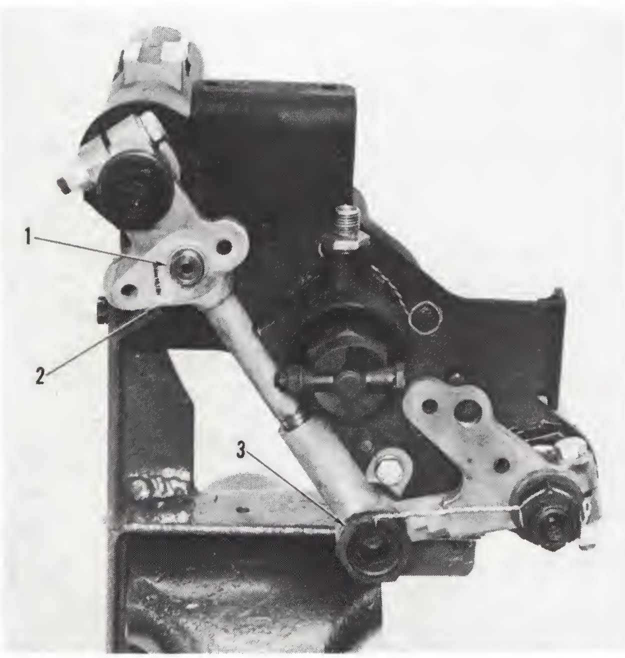


Figure 5-77. Manifold Removal



1. CHECK VALVE ASSEMBLY
2. GASKET
3. NUT

Figure 5-75. Check Valve and Poppet Removal

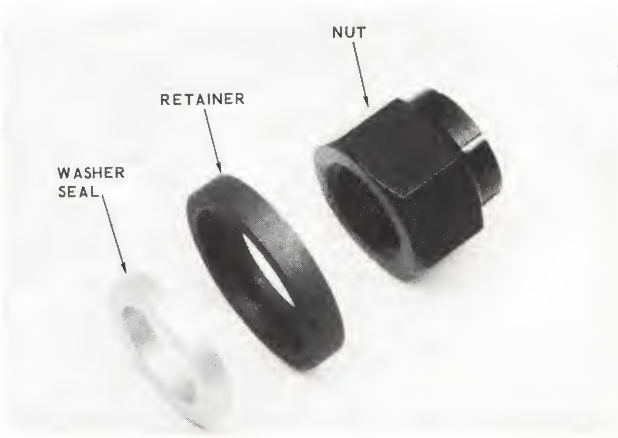


Figure 5-78. Rammer Retainer and Nut

14. Remove bolts (5, figure 5-77), washers (6) and nuts (7). Remove manifold valve body casting (8) and manifold terminal (9). Do not separate manifold halves.

15. Remove keys (1, figure 5-79), nuts (2), lock-washers (3) and rammer housing, piston and ram assembly (see figure 5-80).

NOTE: Lockwasher (3, figure 5-79) is installed with one tab bent against a flat surface of nut (2). When nut is removed discard lockwasher.

16. Remove key (1, figure 5-81) and ram assembly (2) with sear link (3) attached.

17. Remove piston (4). Exercise caution to prevent rammer damper springs (5) and retainer (8) from dropping out of rammer housing (6).

NOTE: Keep rammer damper springs (5) and retainer (8) in same sequence when assembling loader. Inserting a length of lockwire through rammer damper springs (as shown in figure 5-81) before removing rammer damper springs will help maintain sequence.

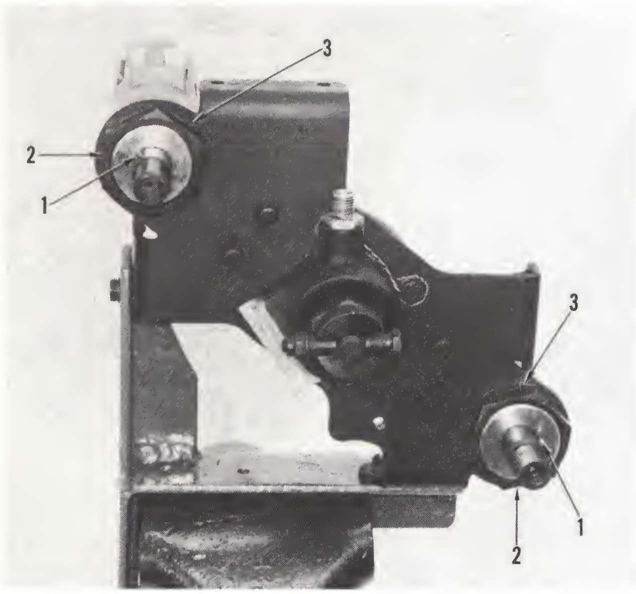
18. Cut lockwire and remove screws (1, figure 5-82), caps (2) and springs (3) from rammer housing (4).

19. Insert screw driver in loader shaft (see figure 5-83). Remove bolt (1), nut (2), spacers (3), declutch cam (4), and declutch piston and declutch cylinder (5).

20. Separate declutch piston and declutch cylinder (see figure 5-84). Discard packings.

21. Hold spring under compression and drive declutch pin (1, figure 5-85) out of loader shaft (2).

22. Slowly release compression on spring (3, figure 5-86).



1. KEY 2. NUT 3. LOCKWASHER

Figure 5-79. Preparation for Rammer Housing Removal

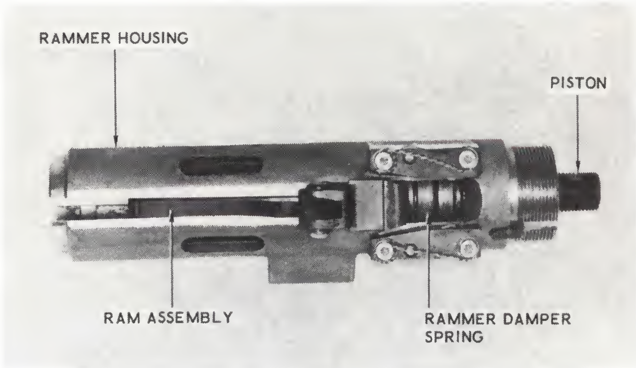
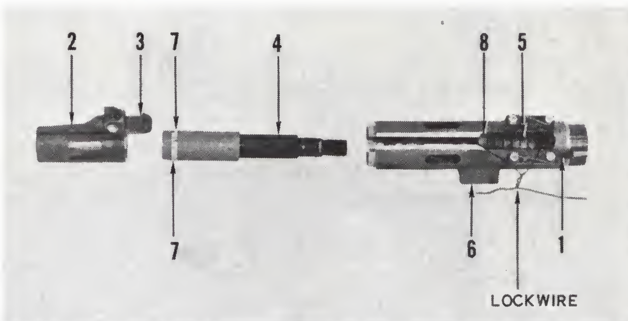
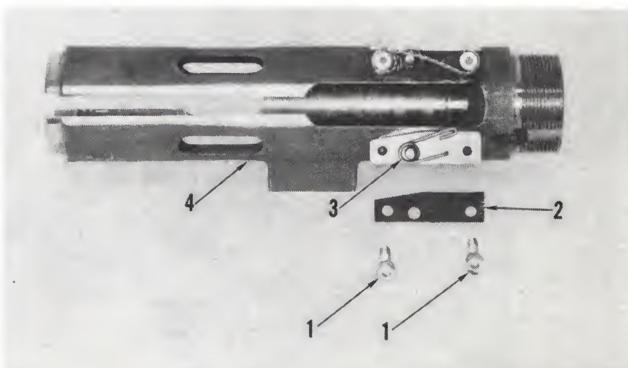


Figure 5-80. Rammer Housing and Associated Parts



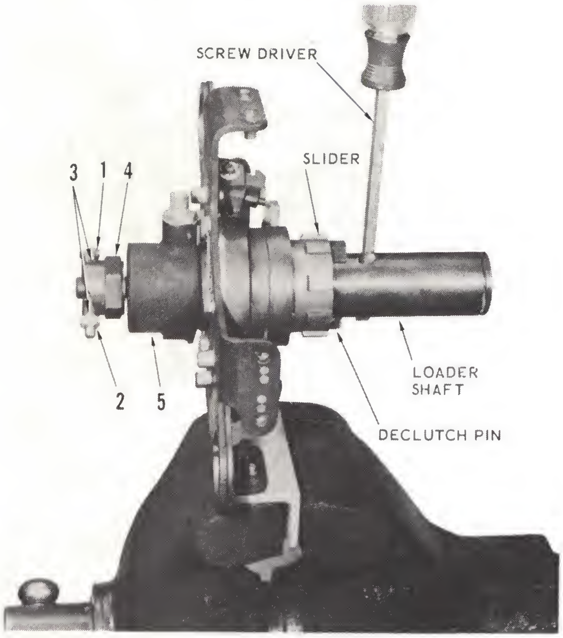
1. KEY
2. RAM ASSEMBLY
3. SEAR LINK
4. PISTON
5. RAMMER DAMPER SPRING
6. RAMMER HOUSING
7. PISTON RING
8. RAMMER DAMPER SPRING RETAINER

Figure 5-81. Disassembled Rammer Components



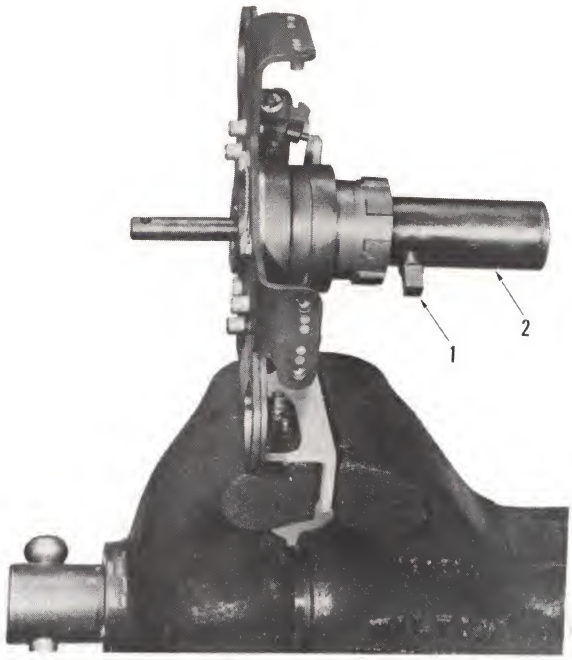
1. SCREW
2. CAP
3. SPRING
4. RAMMER HOUSING

Figure 5-82. Disassembled Rammer Housing



1. BOLT
2. NUT
3. SPACER
4. DECLUTCH CAM
5. DECLUTCH CYLINDER

Figure 5-83. Declutch Components Removal



1. DECLUTCH PIN
2. LOADER SHAFT

Figure 5-85. Declutch Pin Removal



Figure 5-84. Declutch Piston and Declutch Cylinder

Key To Figure 5-86 ➡

1. Slider
2. Slider Bearing
3. Spring
4. Declutch Rod
5. Loader Shaft

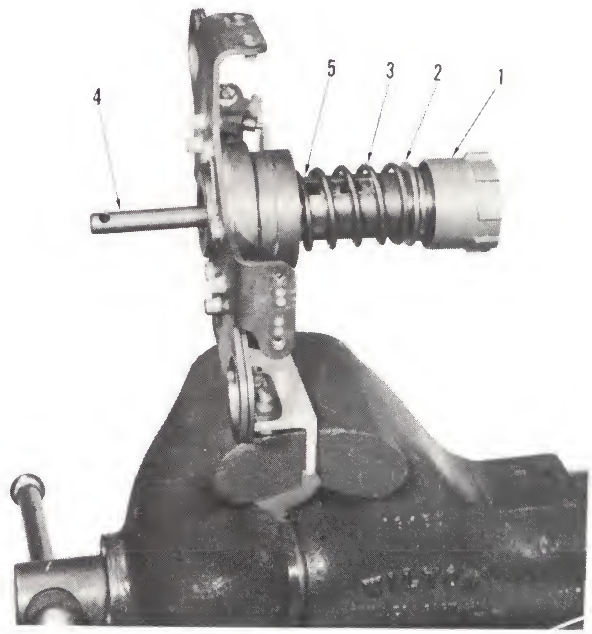


Figure 5-86. Slider Removal

23. Remove slider (1), slider bearing (2) and spring (3).

24. Remove declutch rod (4) and loader shaft (5). (Refer to figure 2-6 for cross sectional view of declutch rod and loader shaft components).

25. Remove back plate assembly (1, figure 5-87) from ramming mechanism holding fixture.

NOTE: Do not remove pin (2), washer (3) or sear (4) unless replacement is necessary.

26. Remove clips (1, figure 5-88). Remove oscillating guide pins (2) and oscillating guides (3) from loader frame (4).

5-39. CLEANING.

5-40. Clean disassembled parts using cleansers listed in Table 5-3. Parts found to be lightly contaminated may be cleaned in a solvent bath with freshly filtered cleaning solvent, Federal Specification, P-D-680, Type I. A stiff bristle brush with an application of solvent, Federal Specification P-D-680, Type I, may be used for scouring. Dry parts cleaned in solvent, using dry compressed air or a clean lint-free cloth. Vapor degreaser, using trichloroethylene, Military Specification MIL-T-7003, may be used to remove stubborn deposits. Remove gall marks by hand honing.

WARNING

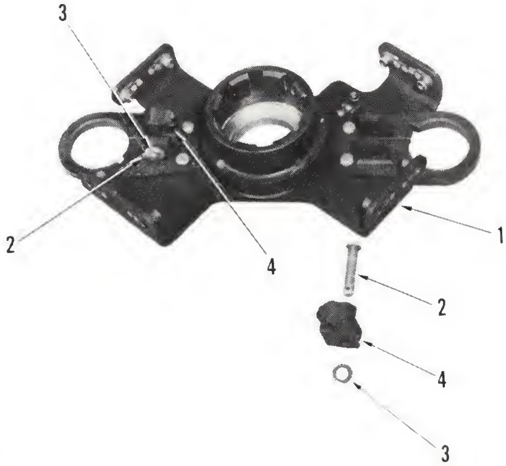
Avoid inhaling fumes from solvents. Avoid skin contact with solvent. Avoid directing compressed air against any part of body.

5-41. INSPECTION.

5-42. Inspect disassembled parts for burrs, scoring, rust or harmful residue from gun gas or lubrication. Those parts requiring special inspection are listed in table 5-4. Do not use any part that has reached maximum usage figure. Return for overhaul any part that has reached maximum usage-before-overhaul figure. Refer to Appendix A, Parts Replacement Schedule, for listing of parts replacement intervals based on number of rounds fired. Do not install parts which do not meet inspection requirements.

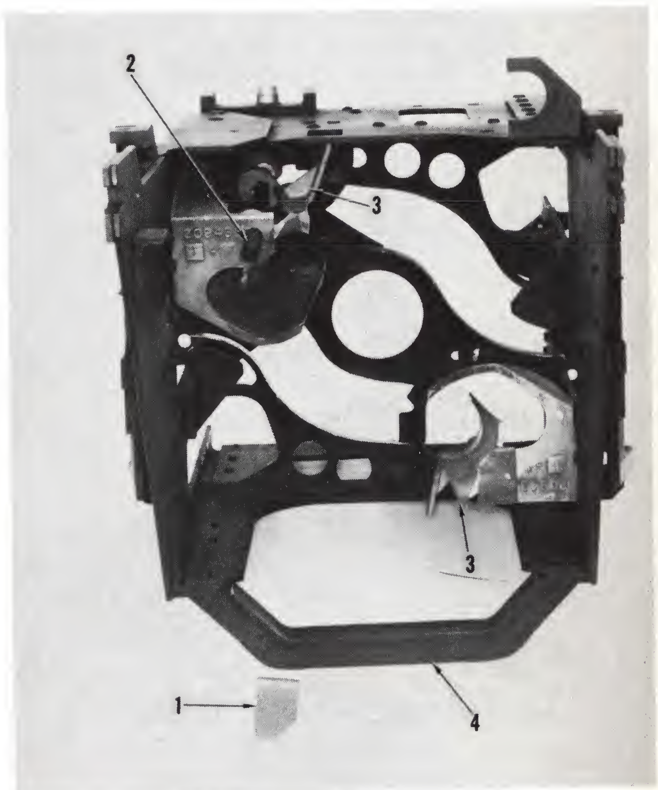
5-43. LUBRICATION.

5-44. Lubrication covered in this section includes lubrication instructions to be observed during assembly. (Refer to paragraph 5-16, step 4, for parts which require periodic lubrication and table 5-2 for a list of lubricants. Table 5-5 lists parts with lubricants to be applied during assembly.



1. BACK PLATE ASSEMBLY
2. PIN
3. WASHER
4. SEAR

Figure 5-87. Back Plate Assembly



1. CLIP
2. OSCILLATING GUIDE PIN
3. OSCILLATING GUIDE
4. LOADER FRAME

Figure 5-88. Loader Frame and Oscillating Guides

TABLE 5-4. INSPECTION

PART	SEE FIG.	INSPECTION
MK 11 GUN		
FIRING PIN HOLDER ASSEMBLY (maximum usage 12,000 rounds)	5-35	Inspect for cracks in casting, insulation and potting compound inside legs, for broken or bent locking lugs, for looseness of insulators with respect to casting, for lack of electrical continuity of circuits, or cross connection between circuits and from circuits to ground. If present, replace firing pin holder assembly.
FIRING PIN (maximum usage 6,000 rounds)	5-35	Inspect for broken, chipped or dulled point (holding pin with fingers, the point will not score the finish on a cartridge case). If present, replace firing pin.
FIRING PIN SPRING (maximum usage 6,000 rounds)	5-35	Inspect for improper length. If length is less than 1 inch, replace spring.
SLEEVE INSULATOR (maximum usage 6,000 rounds)	5-35	Inspect for impaired movement of firing pin in insulator, broken or missing retaining lugs, or cracks. If present, replace insulator.
GUN SEQUENCING SWITCH ASSEMBLY (maximum usage 27,000 rounds)	5-36	Inspect for cracks in housing, damaged wire, damaged tube, loose adjustment nuts, or lack of electrical continuity. If present, replace gun sequencing switch assembly.
GUN JUNCTION BOX (maximum usage 27,000 rounds)	5-37	Inspect for cracked or broken connector attach flange, broken or bent contact springs, lack of continuity of electrical circuits, or grounds and cross feed between circuits. (Normal resistance from each contact spring to ground is 1000±100 ohms; normal resistance between springs is 2000±200 ohms.) If present, replace gun junction box.
REVOLVER CYLINDER SHAFT (maximum usage 50,000 rounds)	5-41	Inspect for cracks and galling along splines. Remove gall marks by hand honing. If cracks are present, replace cylinder shaft.
ROUND POSITIONER ASSEMBLY	5-44	Inspect for broken inner-extractor and looseness of spring pins. If present, replace round positioner assembly.
(a) Round Positioner (machining) (maximum usage 27,000 rounds)	5-44	Inspect for cracks or broken tabs. If present, replace round positioner assembly.
(b) Round Positioner Latch and Retainer (maximum usage 12,000 rounds)	5-44	Inspect for chipped or scored round retention edges, excessive play or cracks. If present, replace latch and retainer.
(c) Round Positioner Spring (maximum usage 12,000 rounds)	5-44	(1) Inspect for cracks, splits or breaks. If present, replace spring. (2) Inspect for improper tension of coil spring (30 to 50 pound tension is required for fully depressed latch or retainer). If present, turn spring over and rewind per paragraph 5-45, step 4.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
REVOLVER CYLINDER ASSEMBLY	5-46	
(maximum usage - before-overhaul 15,000 rounds)		
(a) Revolver Cylinder (maximum usage 51,000 rounds)	5-46	Visually inspect for cracks in chambers, internal splines, and "U" shaped cam surfaces. Check for heavy scoring marks in any of the chambers. If cracks or heavy scoring are present, replace cylinder.
(b) Ring Seal Seats (maximum usage 15,000 rounds)	5-46	Inspect for tightness in cylinder, gas leakage around threads and surfaces in contact with ring seal, and cracks (slight checking on internal lip of seat is permissible). Recondition seats by removing brass deposits under ring seals. If seats cannot be reconditioned, return cylinder assembly for overhaul.
(c) Rifled Insert (maximum usage 15,000 rounds)	5-46	Inspect for cracks or broken lands in rifling. If present, return cylinder assembly for overhaul.
RING SEAL (maximum usage 9,000 rounds)	5-46	Inspect for cracks, wash marks or scratches on sealing surfaces, and evidence of gas leakage past outer diameter of ring (a slight jaggedness on internal diameter of ring is permissible). If present, replace ring seal. Note: If difficulty is experienced in removing seals from cylinder, use ring seal removal tool (see figure 5-7).
RECOIL BOOSTER ASSEMBLY	5-47	(1) Inspect for hampered operation of locking lever, cracks in interrupted threads, and faulty operation of push button. If present, repair or replace defective parts. Note: If parts are replaced, the recoil booster assembly must be adjusted per paragraph 5-58. (2) Inspect bolts holding elbow to booster housing for erosion. If present, replace bolts. (3) Inspect air tube between valve and housing for evidence of excessive leakage. If present, replace air tube.
(a) Charger Valve (maximum-usage-before-overhaul 27,000 rounds)	5-48	(1) Inspect for tightness - cap to solenoid, solenoid to valve. Tighten if required. (2) Inspect electrical receptacle for damage. If present, replace receptacle.
(b) Booster Housing (maximum usage 50,000 rounds)	5-51	Inspect for cracks in trunnions, excessive erosion in first round barrel chamber (erosion of less than half the metal thickness is permissible), and cracks emanating from ports around first-round barrel chamber, in counterbores for eject tubes, and from the smaller diameter around the first round barrel (checking cracks 1/8-inch or less are permissible). If present, replace housing.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
RECOIL BOOSTER ASSEMBLY (continued)		
(c) Gas Elbow (maximum usage 50,000 rounds)	5-51	Inspect for cracks, internal obstruction, or excessive erosion (erosion of less than half the thickness of the metal is permissible). If present, replace gas elbow.
BARREL INSERT	5-52	(1) With insert in barrel, measure erosion (using gage kit M10 (T23) per OP 2574, or equivalent) 55 inches from muzzle of barrel (1.5 inch from breech end). If erosion exceeds 0.025 inch, replace insert.
		(2) Examine breech end surface for cracks or wash marks. If cracks or wash marks are present, replace insert. (If difficulty is experienced in removing inserts use barrel insert removal tool, see figure 5-6.)
FIRST ROUND AND LAST ROUND GUN BARRELS	5-52	(1) Measure erosion (using gage kit M10 (T23) per OP 2574 or equivalent) 50 inches from muzzle. If erosion exceeds 0.025 inch, replace barrel.
		(2) Examine interrupted threads, breech face and area around gas ports for cracks. If cracks are present, replace barrel.
HOLD FORWARD ASSEMBLY (maximum usage 18,000 rounds)	5-54	(1) Inspect for cracked or broken inner and outer springs, cap and retainer. If present, replace parts. Set length of spring to 6.68±0.030 inch from outer faces of cap and retainer (this length may be changed after installation in gun).
		(2) Inspect nut for stripped threads. If present, replace nut.
RECEIVER ASSEMBLY	5-64	(1) Inspect for cracks in cross webs between side members, or excessive play in bushing for main trunnion pin. If present, replace receiver assembly.
		(2) Inspect for galling on brass bearing pads. If present, remove by hand honing.
(a) Gas Transport Tube (maximum usage 27,000 rounds)	5-56	Inspect for cracks around weld, erosion in aft end (erosion of less than half the thickness of the gas transport tube is permissible), or excessive warpage (slight warpage which does not prevent removal of the gas transport tube with light tapping is permissible). If present, replace gas transport tube.
(b) Counter Recoil Damper Assembly	5-57	(1) Inspect for incorrect length (exclusive of projection with interrupted threads, length shall be 10.68±0.030 inches). If length is not within tolerance, replace counter recoil damper assembly.
		(2) Inspect for cracks in bearing, support, interrupted threads, and visible ends of tie rod. Inspect drive pin for excessive play. If present, replace counter recoil damper assembly.
		Note: This assembly should not be disassembled.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
RECEIVER ASSEMBLY (continued)		
(c) Gas Eject Tubes (maximum usage 27,000 rounds)	5-57	Inspect for internal obstructions, cracks, or improper fit in booster block and eject support guide. If present, replace gas eject tube.
(d) Loader Attaching Aft Stud (maximum usage 27,000 rounds)	5-64	Inspect for cracks, damage to area in contact with loader lugs, or excessive play in receiver base. If present, replace aft stud.
SLIDER (maximum usage 27,000 rounds)	5-60	Inspect for cracks, impaired movement of cam followers, or chipped plating on sliding surfaces (slight chipping around edges is permissible). If present, replace slider.
CAM FOLLOWER (maximum usage 12,000 rounds)	5-60	Inspect for impaired movement in slider, heavy markings of the two small flanges (slight marking is permissible), rolling or bulging of material from cam surface onto large end of follower (a slight rolling or bulging is permissible). If present, replace cam follower.
CAM FOLLOWER LOCK KEY (maximum usage 27,000 rounds)	5-61	Inspect for damage around changeover slots, for fore and aft movement in breech, and for warping or bowing. If present, replace lock key.
BREECH ASSEMBLY	5-61	Inspect for cracks in four long members extending from front to rear of breech and around shaft bearing holes, broken or bent switch actuating pin, loose or worn drive pins, or galling in raceways. Remove gall marks by hand honing. If cracks are present, replace breech assembly.
(a) Anvil (maximum usage 50,000 rounds)	5-62	(1) Inspect for cracks, enlarged firing pin holes, excessive loss of plating (slight chipping around edges is permissible). If present, replace anvil. (2) Inspect for looseness in breech. If present, tighten anvil nut.
(b) First Fire and Last Fire Latches (Firing Pin Holder) (maximum usage 12,000 rounds)	5-63	(1) Inspect for excessive play between latch and shaft, cracks or bent tabs. If present, replace latch. (2) Inspect for bent or sheared roll pin. If present, replace roll pin.
(c) Shaft (Firing Pin Holder Latch) (maximum usage 12,000 rounds)	5-63	Inspect for bent shaft, enlarged roll pin holes. If present, replace shaft.
(d) Spring (Firing Pin Holder Latch) (maximum usage 12,000 rounds)	5-63	Check latch mechanism return action. If action is not firm, check free length of spring. If length is less than 1.03 inch, replace spring.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
MK 2 LOADER		
LOADER FRAME ASSEMBLY (maximum usage 50,000 rounds)	5-67, 5-88	(1) Inspect for loose or damaged rivets. If present, replace rivets. (2) Inspect for cracks in side plates, ammo guides, ejection guides, case deflectors, relinking restrictors or rails. (A slight wearing away of sharp edge of case deflectors is permissible.) If present, replace loader. (3) Inspect eject chute posts for damage. If present, repair chute posts.
(a) Oscillating Guide (maximum usage 18,000 rounds)	5-88	Inspect for broken small tab (opposite large tab). If broken, replace oscillating guide.
(b) Spring Clip (maximum usage 9,000 rounds)		Inspect for cracks, distortion and improper fit on case deflector. If present, replace.
(c) Oscillating Guide Pin (maximum usage 27,000 rounds)		Inspect for cracks, bends, and restricted movement in holes in oscillating guides and case deflectors. If present, replace.
RAMMING MECHANISM	5-67, 5-74	(1) Inspect for cracks in the bends in the back plate and for restricted movement of the shaft and clutch mechanisms. If present, return loader for overhaul. (2) Inspect for damaged nutplates on back plate. If present, replace nutplates.
	5-73	(3) Check for retention of air in buffer pistons (these pistons should retain air for several hours after being pressurized during operation) by depressing buffer pistons by hand. If air is not retained, inspect for defects in buffer check valve; if present, replace valve or correct defects in buffer piston (also see (b) below).
(a) Rammer Sear Assembly (maximum usage 27,000 rounds)	5-87	Inspect for cracks, damaged latch surface, damaged roller and bent roller pin. If present, replace sear assembly.
(b) Buffer, Piston and Packings (maximum usage 12,000 rounds)	5-73	Inspect for cracks, restricted movement in washer and retainer, damaged packing and back-up ring, or bulging of small end. If present, replace.
(c) Buffer Stop Washer (maximum usage 12,000 rounds)	5-73	Inspect for cracks and obvious dishing. If present, replace.
(d) Rammer Housing Assembly (maximum usage 27,000 rounds)	5-82	Inspect for cracks, spreading of slot for ram finger, damaged threads or loose pins in spring caps. If present, replace.
(e) Rammer Housing Spring (maximum usage inspection or 12,000 gun rounds)	5-82	Inspect for lack of tension, improper protrusion (.060"-.090" from cap), bends restricting free movement of spring or broken spring. If present, replace.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
(f) Ram Assembly (maximum usage 12,000 rounds)	5-81	Inspect for cracks, bent finger, loose pin, restricted movement of sear link and pitting on inside circumference. (Black bands on the piston rings may indicate pitting inside rams.) If present, replace ram assembly.
(g) Rammer Piston (maximum usage 18,000 rounds)	5-81	Inspect for cracks around inlet port and in piston ring area (slight checking on the large open end is permissible), out-of-round condition on open end (greater than .005" difference between major and minor diameters). If present, replace piston.
(h) Piston Rings (maximum usage 9,000 rounds)		Inspect for collapsed rings (indicated by disappearance of end gap) and impaired movement in grooves in piston. If present, replace complete set of two outer and one inner rings.
(i) Ram Damper Spring Retainer (maximum usage 27,000 rounds)	5-81	Inspect for impaired movement in rammer housing and obvious flattening where the ram strikes the retainer. If present, replace the retainer.
DECLUTCH TUBE BUFFER TUBES COMMON BUFFER TUBE RAMMER VALVE TUBE (maximum usage 27,000 rounds)	5-68, 5-69	Inspect for cracks in tubes, sleeves and nuts, and damaged tube ends. If present, replace tube assembly.
COUPLING HALF, QD 1/4" (maximum usage 27,000 rounds)	5-74	(1) Check tightness in mounting to declutch valve. Tighten if loose. (2) Inspect for damaged pins and mating surface of quick disconnect port. If present, replace coupling half.
DECLUTCH VALVE RAMMER VALVE (maximum usage-before-overhaul 27,000 rounds)	5-74	(1) Inspect for tightness of solenoid on valve and cap on solenoid. Tighten if loose. (2) Inspect electrical connector for damage. If present, replace receptacle.
HEAT BARRIER-CHECK VALVE ASSEMBLY (maximum usage 27,000 gun rounds)	5-75	Inspect for impaired valve action or heavy residue deposit inside valve. If present, replace check valve.
RAMMER VALVE GASKET	5-75	Inspect for flattened rings around middle hole. If present, replace.
MANIFOLD TERMINAL MANIFOLD VALVE BODY (maximum usage 27,000 rounds)	5-77	Inspect for evidence of excessive gas leakage in slip fit between parts, heat cracks around the poppet valve body and erosion in poppet seat area. Note: Do not separate two parts. If present, replace both parts of manifold.
GAS CHECK VALVE NUT (maximum usage 12,000 gun rounds)	5-76	Inspect for bent guide, cracked or closed relief slot, improper poppet opening clearance. (See paragraph 5-61.) If present, replace.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
GAS CHECK VAVLE POPPET (maximum usage 6,000 gun rounds)	5-76	Inspect for cracks, impaired movement on guide, eroded or marred seating area, or improper opening clearance. (See paragraph 5-61.) If present, replace.
LOADER GAS TUBE ("S" Tube) (maximum usage 27,000 rounds)	5-65	Inspect for heat cracks in bends, improper fits on gas transport tube and into manifold, or warpage. If present, replace.
FRONT SPROCKET SPROCKET CLUSTER	5-65	(1) Inspect for bent teeth. If present, straighten. (2) Inspect for crack in slot in front sprocket and tabs on cluster that mate. If present, replace part that is cracked.
POD NOSE		Inspect for looseness of blast suppressor on nose. (1) If loose, remove suppressor and inspect studs in suppressor. If loose, tighten and reinstall suppressor. (2) Check adjustment of latches per figure 5-93.
(a) Blast Suppressor Orifice (maximum usage 9,000 rounds)	5-12	Inspect for excessive erosion (length remaining as measured along internal diameter must be 0.75 inch). If erosion exceeds allowable limits, replace orifice.
POD BODY		
FEED CHUTE	4-23, 4-24, 4-25	Inspect for damage to latches, ammunition guides, or flanges and for improper flow of ammunition belts through the chutes (check with a short belt of dummy ammunition). If present, replace chute.
EJECTION TUBE	5-14	Inspect for cracks, bulges in the tubing walls, or improper action of the latching mechanism. If present, replace tube.
PNEUMATIC QUICK DISCONNECTS	5-15 (1) 5-20 (2)	(1) Inspect for improper fit to mating coupling half. If present, replace hose and quick disconnect assembly. (2) Inspect for damage to packings ("O" rings) in couplings. If present, replace packings.
ELECTRICAL CONNECTORS (Plugs) (maximum usage 27,000 rounds)	5-20 (1) 5-15 (2, 4) 5-19 (1, 2)	(1) Inspect for improper fit and retention on receptacles on gun and loader. If present, replace connectors. (2) Check for loose mechanical connection to conduit. If present, tighten.
TRUNNION BLOCKS	5-20	Inspect for broken or loose dowel pins (that protrude forward from trunnion blocks), improper latching action in trunnion latches, or damaged rivets and bolts that secure the trunnion blocks into pod. If present, return pod body for overhaul.
NOSE AND TAIL LATCHING POST		Check tightness of cross pin. If loose, restake pin.

TABLE 5-4. INSPECTION (continued)

PART	SEE FIG.	INSPECTION
CONTROL BOX SHOCK MOUNTS	5-8	Inspect for damage. If present, replace shock mounts.
VALVE AND TRAY ASSEMBLY (maximum usage-before-overhaul 27,000 rounds)	5-27, 5-28	Inspect for improper mechanical action and improper operation of main door interlock. If present, replace valve and tray assembly.
POD JUNCTION BOX	5-33	Check tightness of conduit fittings into box, nuts on terminal strip studs and nut holding rate-of-fire switch. Tighten any of these items that are loose.
FEED THROATS		Inspect for cracks and any deformed sections of the throats. If present, return pod structure for overhaul.
FEED THROAT ADAPTERS	5-24	Inspect for damaged parts and improper fit with loading tools. If present, replace damaged part.
FEED MECHANISM ASSEMBLY	5-23	Inspect for improper operation by rotating ammunition sprocket crank and indexing crank. If present, replace feed mechanism assembly.
PNEUMATIC MOTOR VALVE (maximum usage-before-overhaul 27,000 rounds)		(1) Inspect for tightness - cap to solenoid, solenoid to valve. Tighten if required. (2) Inspect electrical receptacle for damage. If present, replace receptacle.
MAGAZINE	(5-31 (2)	(1) Check each tray for presence of any objects such as portions of ammuntion belts, links or dislocated ammunition noses by viewing trays from rear of magazine (with tail removed). If present, remove objects. (2) Inspect for damaged ammunition hooks by watching through the feed throats as magazine is rotated with the indexing crank. If present, remove magazine for repair.
PNEUMATIC RESERVOIR	5-26	(1) Inspect for cracks in mounting brackets on reservoir. If present, replace reservoir. (2) Inspect for damage to glass or hand in pressure gage. If present, replace pressure gage.
POD TAIL	5-93	Check adjustment of latches (see figure 5-93).

TABLE 5-5. LUBRICATION

PART	SEE FIGURE	LUBRICANT	AREA TO BE LUBRICATED
MK 11 GUN			
Revolver Cylinder	5-46	Lubriplate No. 215	Lightly pack "U" shaped cam curved surfaces in area where cam followers contact revolver cylinder. Coat center bore of revolver cylinder.
Insulator Assembly	5-35	Lubriplate No. 215	Fill insulator assembly 1/10 full.
Bronze Receiver Bearing Inserts	5-64	Lubriplate No. 215	Coat surface of area which contacts breech.
Breech Assembly Bearing Receiver Pad Slots	5-63	Lubriplate No. 215	Coat surface of breech slots which contact bearings.
Slider Pins	5-60	Lubriplate No. 215	Coat surface of pins.
Cam Follower	5-60	Lubriplate No. 215	Coat entire outer surface.
Cylinder Shaft	5-41	Lubriplate No. 215	Coat cylinder shaft in bearing and splined area
Cylinder Shaft Bearing	5-41	Lubriplate No. 215	Coat bearing surface.
Yoke Shaft	5-63	Lubriplate No. 215	Coat surface of yoke shaft.
Round Positioner Retainer	5-44	Lubriplate No. 215	Coat area extending beyond outer edge of positioner.
Round Positioner Spring	5-44	Lubriplate No. 215	Coat spring surface, wipe off excess, rewind and lightly pack spring after installation.
Round Positioner Latch	5-44	Lubriplate No. 215	Coat area extending beyond outer edge of positioner.
LOADER			
Declutch Slider Spring	5-86	Lubriplate No. 215	Coat entire surface.
Slider	5-86	Lubriplate No. 215	Coat entire surface.
Front Sprocket	5-63	Lubriplate No. 215	Lightly pack splined area and bore.
Sprocket Cluster Assembly	5-67	Lubriplate No. 215	Coat entire surface. Lightly pack internal surfaces.
Declutch Rod	5-86	Lubriplate No. 215	Coat surface.
Declutch Cylinder	5-84	Lubriplate No. 215	Coat counterbore and inside diamete
Swivel		Lubriplate No. 215	Coat entire surface.
Slider Bearing	5-86	Lubriplate No. 215	Coat entire surface.
Rammer Piston	5-81	Lubriplate No. 215	Coat outer surface in area of contac with ram assembly.
Rammer Damper Spring	5-81	XP190	Grease tapered mating surfaces of individual rings.

TABLE 5-5. LUBRICATION (continued)

PART	SEE FIGURE	LUBRICANT	AREA TO BE LUBRICATED
LOADER (continued)			
Rammer Damper Spring	5-81	XP271	Pack inside and outside surfaces of assembled spring. Area to be 1/2 to 2/3 full of grease.
Buffer Retainer	5-73	Grease per MIL-G-4343	Coat entire bore.
Buffer Piston	5-73	Grease per MIL-G-4343	Fill groove before installing back-up ring and packing.
Anti-Bounce Springs	5-82	Lubriplate No. 215	Lightly pack opening in rammer housing in area around anti-bounce spring.
Packings and Gaskets	5-73	MIL-G-4343	Coat entire surface of all O-rings and gaskets.
Pneumatic Fittings	5-69	Grease per MIL-G-4343	Lightly coat mating surfaces prior to assembly.
POD			
Gun Hanger Tracks and Aft Brackets	5-89	Lubriplate No. 215	Lightly coat hanger and bracket surfaces to assist in sliding MK 11 gun in and out of pod body.
Trunnions	5-89	VV-L-800	Surfaces of moving parts.
Lugs	3-4	Lubriplate No. 215	Coat hook areas and sliding surfaces.
Magazine Bearings		Lubriplate No. 215	Coat bearing surface.
Pneumatic Motor	5-90	VV-L-800	Apply 5 to 10 drops of oil through cut out area in casting.

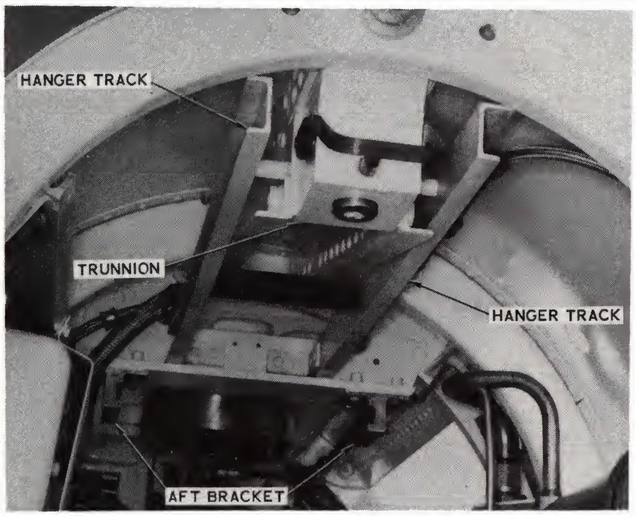


Figure 5-89. Gun Hanger Tracks and Aft Brackets Lubrication Points

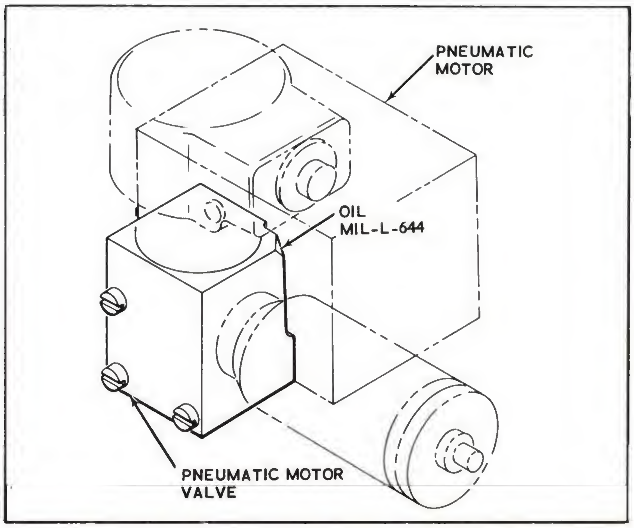


Figure 5-90. Pneumatic Motor Lubrication Points

5-45. ASSEMBLY OF GUN MECHANISM. Assemble gun mechanism by installing parts removed during disassembly in the reverse order of disassembly and observing the following instructions:

1. Refer to table 5-5 for a complete list of gun mechanism parts requiring lubrication during assembly.

2. Replace all packings exposed during disassembly. Apply Lubricant No. 5 (see table 5-2) to all packing surfaces.

3. Prior to installing gun junction box (see figure 5-36), gun sequencing switch (see figure 5-36), or recoil booster assembly (see figure 5-51), refer to paragraph 5-55 for adjustment instructions.

4. Rewind spring (1, figure 5-44) by installing latches (2) and one retainer (3) and winding spring into the round positioner (4) in counterclockwise direction. After spring is wound into positioner, insert remaining retainer, which will put a preload on spring.

5. When installing revolver cylinder in breech, place the revolver cylinder so the long end of the forward cam is positioned over the forward cam follower (see figure 5-91). Roll the revolver cylinder into the breech. The cam followers must enter the revolver cylinder cams. If caution is not exercised, it is possible to put revolver cylinder into breech with the cam followers out of the cams.

5-46. ASSEMBLY OF LOADER. Assemble loader by installing parts removed during disassembly in reverse order of disassembly and observing the following instructions:

1. Refer to table 5-5 for a complete list of loader parts requiring lubrication during assembly.

2. Replace all packings exposed during disassembly. Apply Lubricant No. 5 (see table 5-2) to all packing surfaces.

3. Prior to installing rammer piston rings (7, figure 5-81), anti-bounce spring (3, figure 5-82), or poppet (see figure 5-76), refer to paragraph 5-55 for adjustment instructions.

4. Coat tapered surfaces of rammer damper springs (5, figure 5-81) with Lubricant No. 3 (refer to table 5-2). Apply Lubricant No. 4 (refer to table 5-2) to inside and outside surfaces of rammer damper springs so area around installed spring is between one half and two thirds full of grease.

5. Apply Lubricant No. 2 (refer to table 5-2) to rammer sear link (3, figure 5-81) and spring inside sear link.

6. Unsear rams (see figure 5-80) and position rams forward so that rammer piston (4, figure 5-81) is exposed. Apply Lubricant No. 1 (refer to table 5-2) to piston. After application of lubricant, resear rams.

7. Install rammer housing key (1, figure 5-81) before installing nut (2, figure 5-79).

8. Tighten nuts (2, figure 5-79) to a torque value of 850 ± 50 inch-pounds.

9. Bend one tab of lockwasher (3, figure 5-79) against a flat surface of nut (2).

10. Install rammer piston keys (1, figure 5-79) before installing manifold (see figure 5-77).

11. Tighten nuts (3, figure 5-77) to a torque value of 425 ± 25 inch-pounds.

12. Tighten nuts (7) to a torque value of 225 ± 25 inch-pounds.

13. Tighten nuts (3) to a torque value of 525 ± 25 inch-pounds.

5-47. ASSEMBLY OF POD BODY. Assemble pod body by assembling and installing the pod body major components and subsystems removing during disassembly in the reverse order of disassembly.

5-48. ASSEMBLY OF ELECTRICAL SYSTEM. Assemble the electrical system by installing parts removed during disassembly in the reverse order of disassembly.

5-49. ASSEMBLY OF AMMUNITION MAGAZINE. Assemble the ammunition magazine by installing parts removed during disassembly and observing the following instructions:

1. Tighten nut (12, figure 5-22) until there is no forward to aft end play at the shaft extending through the center of the magazine when the magazine is installed.

CAUTION

With nut (12, figure 5-22) tightened and no end play at the shaft, verify that magazine is free to rotate.

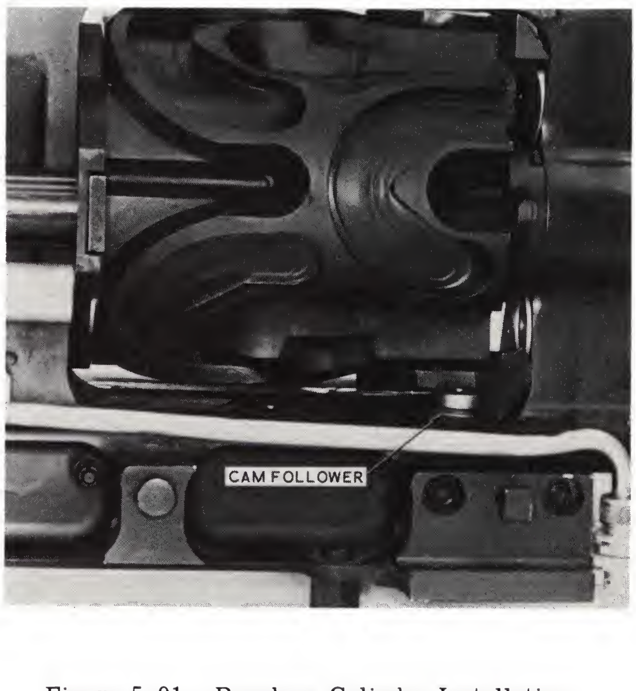


Figure 5-91. Revolver Cylinder Installation

5-50. ASSEMBLY OF PNEUMATIC SYSTEM. Assemble pneumatic system by installing parts removed during disassembly in the reverse order of disassembly and observing the following instructions:

1. Replace all packings exposed during disassembly.

2. Apply Lubricant No. 5 (refer to table 5-2) to new packings.

5-51. ASSEMBLY OF FEED SYSTEM. Assemble the feed system by installing parts removed during disassembly in the reverse order of disassembly.

5-52. ASSEMBLY OF GUN POD. Assemble the gun pod by installing parts removed during disassembly in the reverse order of disassembly. If pod latches require adjustment, refer to paragraph 5-61.

5-53. COMPONENT REPAIR.

5-54. Most component repair is not practical beyond the point of minor deburring and thread chasing except that standard aircraft practices can be followed for sheet metal repair of the pod nose, pod body and pod tail. Most repairs will be accomplished by parts replacement.

5-55. ADJUSTMENTS. Most adjustments required for the gun pod are accomplished during assembly. Instructions included here provide the information necessary to perform all adjustments. These adjustments must be performed either during assembly of the subject part or immediately after part installation.

5-56. Gun Junction Box. Adjust gun junction box contacts with hold forward assembly (see figure 5-54) and firing pin holder assembly (see figure 5-33) removed in accordance with the following instructions:

1. Position breech in fully forward position.

2. Mark breech to indicate location of aft end of receiver.

3. Slide breech aft in receiver until breech is moved 1/8 inch from original position and mark breech again to indicate location of aft end of receiver.

4. Slide breech further aft in receiver and install firing pin holder assembly.

5. Connect an ohmmeter across pins 1 and 2 of receptacle on gun junction box (see figure 5-36).

6. Connect a second ohmmeter across pins 3 and 4.

7. Slide breech forward until ohmmeters indicate contact and check position of breech relative to second mark made on receiver. Aft end of receiver must align (±1/16 inch) with the second mark made on breech. If aft end of receiver is not within 1/16 inch of second mark on breech, remove firing pin holder and bend gun junction box contacts forward or aft as required.

CAUTION

Bend contacts in area extending beyond insulators. Caution must be exercised to prevent destroying preloading on contact.

8. Repeat steps 4 through 7 until ohmmeters indicate contact when breech is aligned (±1/16 inch) with the second mark on receiver.

5-57. Gun Sequencing Switch. Adjust setting of gun sequencing switch (see figure 5-38) in accordance with the following instructions:

1. Measure distance between the switch body (1, figure 5-92) and the shoulder at the base of thread on switch rod (dimension A, figure 5-92). Dimension A must be 0.750 ±0.020 inch.

2. If adjustment is necessary, remove switch body (refer to paragraph 5-37, step 3), loosen check nut (2, figure 5-92) on switch rod (3), and rotate end (4).

NOTE: A hole is provided for insertion of an awl to keep switch rod from turning when end is rotated.

5-58. Recoil Booster Assembly. Prior to installing gun barrels, barrel lock must be adjusted. Partially assemble recoil booster assembly by reversing disassembly instructions given in paragraph 5-36, step 19. Adjust barrel locking mechanism in accordance with the following instructions:

1. Place partially assembled recoil booster assembly in position on receiver.

2. Assemble parts of recoil booster assembly by reversing disassembly instructions given in paragraph 5-37, step 17.

3. Slide parts assembly in step 2 above onto partially assembled booster housing until forward edge of lock bolt (6, figure 5-49) threads are flush with face of counter recoil damper (see figure 5-57). Rotate lock bolt and engage threads.

4. Tighten adjusting nut (4, figure 5-51) so key on locking lever (5) fits into slot on adjusting nut. Boss on booster housing (11) must be 1/16 inch from seating position in receiver.

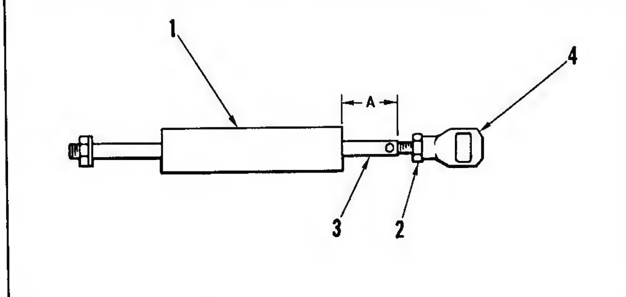


Figure 5-92. Sequencing Switch Adjustment

5. Install parts removed in accordance with instructions in paragraph 5-36, step 17, except do not install safety wire.

6. Place locking lever in locked position by depressing push button (8, figure 5-51) and rotating locking lever downward. Locking lever must move freely across face of push button until lever is covering approximately 1/32 inch of the push button face. At this point, to continue rotating locking lever will require force. When locking lever is in fully locked position, the lever must be free of the push button face so that button is in an extended position, and the booster housing boss must be firmly seated against the receiver.

7. If rotating locking lever to locked position does not require force, or boss on booster housing does not firmly seat in receiver, remove barrel lock (3) and loosen or tighten adjusting nut (4). Install barrel lock and check locking action in accordance with step 6 above.

5-59. Rammer Piston Rings. Set gap in rammer outer piston rings (7, figure 5-81) in accordance with the following instructions:

1. Position piston ring to be checked inside ram (2) at a point beyond chamfer. Measure piston ring gap. Gap must be 0.030 ± 0.005 inch.

2. Remove piston ring and repeat procedure described in step 1 above for second piston ring.

5-60. Anti-Bounce Spring. Adjust anti-bounce spring (3, figure 5-82) to protrude 0.075 ± 0.015 inch beyond surface of cap (2). Measure distance from face of cap to furthest edge of anti-bounce spring.

5-61. Gas Check Valve. Prior to installing gas check valve poppet (see figure 5-76), check poppet gap in accordance with the following instructions:

1. Select a washer with inside diameter large enough to slip over guide (see figure 5-76) and outside diameter no larger than face of guide (see figure 5-76). Measure thickness of washer and slide washer over guide.

2. Install poppet in manifold and screw nut with guide attached into manifold until poppet bottoms.

3. Measure distance between face of manifold and nearest face of nut (see figure 5-76).

4. Subtract the measured distance from the washer thickness. This difference is the poppet gap and must be 0.058 ± 0.010 inch. If gap is not within specified tolerance, replace nut and poppet and recheck gap. If proper gap is not achieved by replacing nut and poppet, replace manifold and recheck gap.

5-62. Pod Latches. Adjust pod latches (see figure 5-11) in accordance with the following instructions:

1. Close latch cover to the point where resistance is felt and measure distance from pod skin to top of latch. This distance must be between 2-1/2 inches and 2-5/8 inches. (See figure 5-93.)

2. Adjust nut (see figure 5-93) tighter to increase distance or loosen nut to reduce distance, as required.

3. After adjustment is complete, bend tabs on tab washer.

5-63. FAULT ISOLATION.

5-64. Malfunctions encountered during inspection or operation would be due to one or more of the following failures: Failure to fire; failure to ram; failure to eject; failure to feed ammunition; failure to charge; failure to clear. Each of these failures produces one or more indications which are peculiar to the particular failure. Table 5-6, Failure Indications, provides a cross-reference from failure indications to the type of failure which produces those indications. Tables 5-7 through 5-12 provide cross-references from the types of failures to the methods of isolating and remedying the probable causes of the failures. Table 5-13 provides information necessary for locating and remedying faults found in the link loading machine.

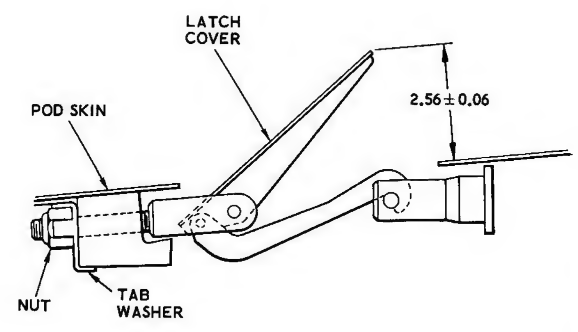


Figure 5-93. Pod Latch Adjustment

TABLE 5-6. FAILURE INDICATIONS

FAILURE INDICATIONS	TYPE OF FAILURE
Live rounds ejected or gun continuously changes when trigger is depressed and held.	Failure to fire (see Table 5-7)
Cylinder stopped by rounds protruding from cylinder chamber too far to clear breech.	Failure to ram (see Table 5-8)
Round jammed in cylinder eject station and MK 11 gun will not cycle when charged.	Failure to eject (see Table 5-9)
Ammunition not moving from magazine to MK 11 gun.	Failure to feed ammunition (see Table 5-10)
MK 11 gun will not cycle when charged.	Failure to charge (see Table 5-11)
MK 11 gun will not clear when cycled.	Failure to clear (see Table 5-12)

TABLE 5-7. FAILURE TO FIRE CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Live rounds eject on first round barrel side. Gun may continue to charge automatically as long as trigger is depressed.	Power and control system to gun pod defective.	Connect Gun Pod Tester MK 39 Mod 0 (see figure 5-5) to aircraft main connector and perform tests in accordance with paragraph 5-12.	Correct deficiencies located by isolation procedure.
	Gun pod junction box (figure 5-32) defective.	Refer to figure 2-31 and perform continuity check between gun pod main connector (J301) and connectors (P101, P102,P206, P207, P302 and P303). Check for shorts between all ungrounded connector pins and ground.	Replace connectors on gun pod junction box if defective.
	Pod control box (figure 5-8) defective	Connect Control Box Tester MK 38 Mod 0 (see figure 5-4) to pod control box and perform tests in accordance with paragraph 5-11.	Replace pod control box if defective.
	Gun junction box (1, figure 5-37) defective.	Refer to figure 2-31 and perform continuity checks between connector (J201) and springs (4, figure 5-37); check for shorts between connector (J201) pins and ground; resistance between connector (J201) pin 2, and ground, and pin 4 and ground must be 1000 ±100 ohms.	Replace gun junction box if defective.

TABLE 5-7. FAILURE TO FIRE CAUSE ANALYSIS (continued)

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
	Firing pin holder assembly (2, figure 5-34) defective	Inspect firing pin holder casting for cracks and breaks; inspect contact pins and insulators for breaks; perform continuity checks between contact pins and contacts, and check for shorts to firing pin holder casting.	Replace firing pin holder assembly if defective.
	Firing pin sleeve (1, figure 5-35) broken	Inspect firing pin sleeve for breaks or cracks.	Replace firing pin sleeve if defective.
	Firing pin spring (3, figure 5-35) defective	Inspect firing pin spring for deformation; check that free length of spring is approximately 1.09 inch.	Replace firing pin spring if defective.
	Firing pin (2, figure 5-35) is dulled	Inspect ejected rounds for scratch marks on primer	Replace firing pin if defective.
	Firing pin (2, figure 5-35) dirty or insufficiently lubricated.	Inspect firing pin for accumulation of dirt and lack of lubricant.	Clean firing pin and lubricate in accordance with Table 5-5.
	Firing pin hole in anvil (4, figure 5-61) obstructed	Inspect anvil for accumulation of dirt or foreign substance in firing pin hole.	Clean anvil; replace if necessary.
	Gun being held out of battery position by 1/8 inch or more.	Inspect gun mechanism to determine that rear surfaces of firing pin holder assembly and gun junction box (see figure 5-34) are aligned; check that springs (see figure 5-37) are contacting contact pins in firing pin holder assembly.	Repair gun mechanism or gun loader mechanism if malfunctioning.
Live rounds eject on last round barrel side.	Same as first fire barrel possible causes.	Same as first fire barrel isolation.	Same as first fire barrel remedies.
	Sequencing switch assembly (3, figure 5-36) defective.	Perform continuity check through sequencing switch (S202) with switch in recoil position.	Replace sequencing switch assembly if defective.
Gun fires at slow rate with rate of fire switch (see figure 4-27) in slow or fast position.	Rate of fire switch defective.	Refer to figure 2-31 and perform continuity check through rate of fire switch. (S302)	Replace rate of fire switch if defective.

TABLE 5-8. FAILURE TO RAM CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Rounds are not seated completely into revolver cylinder and gun stops when rounds fail to clear side of breech assembly.	Insufficient gas pressure in system between first round barrel port and rammer assembly (see figure 2-26).	Inspect elbow (10, figure 5-51) for breaks, cracks, and security of attachment to booster housing (11).	Secure elbow; replace if defective.
		Inspect gun gas tube (10, figure 5-56) and loader gas tube (see figure 5-16) for damage and wear.	Replace defective tubes.
		Manifold (see figure 5-77) defective or insecure.	Secure manifold; replace if defective.
		Nut (3, figure 5-75) defective or insecure.	Secure nut; replace if defective.
		Poppet (see figure 5-76) clearance incorrect.	Adjust poppet clearance in accordance with paragraph 5-61.
		One or more rammer components (see figure 5-81) defective.	Replace defective components.
	Round blown out of revolver cylinder after ramming by gun gas leak due to poor cylinder to barrel sealing. NOTE This type of leak indicated by ring mark on neck of round, and nose and neck of round blackened by gun gas.	Inspect barrel inserts (1, figure 5-52), ring seal (1, figure 5-46), and ring seal seat (2, figure 5-46) for washed condition.	Replace washed parts.
	Round bounced out of revolver cylinder after ramming. NOTE Bouncing after ramming is indicated by ring mark on neck of round, and an absence of blackening by gun gas.	Inspect round positioner assembly (see figure 5-44) for defective latches (2) and broken round positioner (4). Check that 30 to 50 lbs of pressure is required to fully depress latch; less pressure indicates a defective spring (1).	Rewind spring in accordance with paragraph 5-45, step 4; replace latches, spring or round positioner assembly if defective.
Rounds are not moved out of links and remain in ram station causing loader assembly to jam.	One or both rams failed to latch in the resear position.	Inspect ramming mechanism (see figure 5-67) for broken sear, sear link, and ram finger.	Replace defective parts.

TABLE 5-8. FAILURE TO RAM CAUSE ANALYSIS (continued)

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Rounds are not moved out of links and remain in ram station causing loader assembly to jam. (continued)		Inspect rammer damper springs (5, figure 5-81) and springs (3, figure 5-82) for breaks and deformation.	Replace springs if defective.
		Inspect all buffer assembly (see figure 5-73) parts for damage. Pay particular attention to the washer (6), piston (5), and check valve (1).	Replace defective parts.
	Defective links.	Inspect links for breaks, out-of-place RADHAZ caps, and broken spot-weld on carrier.	Replace defective links and reload.
	Defective oscillating guides (3, figure 5-88) front sprocket (2, figure 5-65) or bent or damaged loader frame.	Inspect parts for breaks and deformation.	Replace defective parts.
	Lack of gas pressure in system between first round barrel port and rammer assembly (see figure 2-26).	Same as for insufficient gas pressure in this system.	Same as for insufficient gas pressure this system
	Improperly loaded ammunition.	Check that links line up in back of rounds in revolver cylinder and that the quantity of empty links is the same as the number of rounds in the cylinder.	Reload ammunition properly (refer to paragraph 4-9).

TABLE 5-9. FAILURE TO EJECT CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Unextracted case remains in revolver cylinder and round positioner (1, figure 5-42) stops gun with case in eject station to prevent double ramming.	Inner extractor (5, figure 5-44) damaged or excessively worn; outer extractor (2, figure 5-42) damaged or missing. NOTE This type of extraction failure indicated by case being firmly seated in revolver cylinder and a lack of extractor marks on case rim.	Visually verify that extractors are installed, and inspect inner and outer extractors for damage, or excessive wear.	Replace defective and missing parts.

TABLE 5-9. FAILURE TO EJECT CAUSE ANALYSIS (continued)

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Unextracted case remains in revolver cylinder and round positioner (1, figure 5-42) stops gun with case in eject station to prevent double ramming.	Case split, galled, or when high decarb cases are used, wax omitted during loading. NOTE This type of extraction failure indicated by deep extractor marks on case rim.	Remove stuck case and inspect for splits, breaks, and galling.	Wax high decarb cases during ammunition loading.
	Case broken free but not ejected from revolver cylinder.	Inspect gas eject tubes (2, figure 5-59) for breaks.	Replace gas eject tube if defective.
Case ejected from revolver cylinder, but does not clear loader or ejection tube and jams in oscillating guides or ejection tube.	Loop on link broken.	Inspect link for breaks.	Replace defective links.
	Link RADHAZ cap defective. NOTE This type of extraction failure indicated by case ejecting through link, leaving link in loader.	Inspect link for missing base at RADHAZ cap.	Replace defective link.
	Oscillating guide (3, figure 5-88), oscillating guide pin (2), clip (1), or ejection tubes (3, 4, figure 5-14) broken.	Inspect parts for breaks.	Replace defective parts.

TABLE 5-10. FAILURE TO FEED CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Ammunition is not boosted from magazine into feed chutes. Gun fires at a subnormal rate and stops while aircraft is subject to G forces, and belts jam in feed throats or sprocket areas.	Electrical power not available at ammo-drive pneumatic motor valve (see figure 5-30).	Refer to figure 2-31 and check for power at connector (P302).	Correct deficiencies located by check.
		Perform continuity check through last round switch (19, figure 5-22).	Replace last round switch if defective.
		Connect Control Box Tester MK 38 Mod 0 (see figure 5-4) to gun pod control box (refer to paragraph 5-10) and perform tests in accordance with paragraph 5-11.	Replace gun pod control box if defective.

TABLE 5-10. FAILURE TO FEED CAUSE ANALYSIS (continued)

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Ammunition is not boosted from magazine into feed chutes. Gun fires at a subnormal rate and stops while aircraft is subject to G forces, and belts jam in feed throats or sprocket areas. (continued)	Ammo-drive pneumatic valve (see figure 5-30) inoperative.	Turn air on at valve and tray assembly (6, figure 5-27). If power was found at connector (P302) in preceeding steps, and pneumatic motor does not run, ammo-drive pneumatic motor valve is probably inoperative.	Replace ammo-drive pneumatic motor valve.
	Ammunition feed assembly inoperative.	Attempt to rotate sprocket shaft (2, figure 5-22) or magazine (see figure 4-13). If neither will rotate, ammunition feed system is inoperative.	Replace ammunition feed assembly.
	Magazine (see figure 4-13) improperly indexed.	Inspect ammunition belt for binding between magazine and feed throat.	Remove jammed ammunition, reload, and index magazine. NOTE Index marks on magazine apply only when loading tray is completely filled with ammunition.
Ammunition jams in feed chutes or at entrance to loader; round out of link detent.	Defective feed chutes.	Inspect feed chutes for damage and excessive wear with feed chute off pod. Check that short ammunition belt passes through feed chute freely.	Replace feed chutes if defective.
	Chute mismatched to loader.	Install empty feed chute on loader and check that feed chute loop guides align with rails in loader.	Replace feed chute if defective.
Ammunition belt jams in feed sprockets, feed chutes, or at entrance to loader, and belts separate leaving a portion of the belt in magazine trays. NOTE Ammunition belt separation may be a result of ammunition not being boosted from magazine into feed chutes, or ammunition jamming in feed chutes. Check these malfunctions if links are not defective.	Defective links	Inspect links for broken C spring and broken lug.	Replace defective link. NOTE If ammunition belt separation occurs in magazine, remove all ammunition from trays where separation occurred and reload.

TABLE 5-11. FAILURE TO CHARGE CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Gun fails to cycle.	Defective charger valve. (2, figure 5-47)	Refer to figure 2-31 and apply power to charger valve; make sure charger valve opens.	Replace charger valve if defective.
	Mechanical failure in gun mechanism.	Inspect slider link (3, figure 5-58), cam followers (1, 5) and hold forward spring (see figure 5-54) for damage and deformation. Inspect revolver cylinder shaft (4, figure 5-41) and bearing inserts (1, figure 5-64) for evidence of galling.	Replace defective parts.
	Sequencing switch assembly (3, figure 5-36) defective.	Place sequencing switch (S202) in battery position. Refer to figure 2-31 and check for continuity between pins 4 and 6 of connector. (J202)	Replace sequencing switch assembly if defective.
	Control box (1, figure 5-8) defective.	Connect MK 38 Mod 0 Control Box Tester (see figure 5-4) to pod control box (refer to paragraph 5-10) and perform tests in accordance with paragraph 5-11.	Replace pod control box if defective.
	No air supply to gun.	Air turned off at valve and tray assembly (6, figure 5-27) pressure regulator on valve and tray assembly defective, or air pressure in reservoir (6, figure 5-26) low.	Turn air on. Replace pressure regulator if defective, and recharge reservoir.
Gun fails to ram during charge cycle.	Rammer valve (5, figure 5-15) defective	Refer to figure 2-31 and apply power to rammer valve; make sure rammer valve opens.	Replace rammer valve if defective.
NOTE Refer to Table 5-8 for failure to ram causes and remedies.	Low air pressure.	Check air pressure at reservoir (6, figure 5-26).	Recharge reservoir.
Gun fails to eject during charge cycle. NOTE Refer to Table 5-9 for failure to ram causes and remedies.	Air eject tube (1, figure 5-57) defective.	Inspect air eject tubes for breaks.	Replace air eject tube if defective.

TABLE 5-12. FAILURE TO CLEAR CAUSE ANALYSIS

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Gun fails to cycle.	Same as Table 5-11, failure to charge.	Same as Table 5-11, failure to charge.	Same as Table 5-11, failure to charge.
Gun continues to ram.	Defective pneumatic declutch valve (3, figure 5-15).	Check mechanical operation by pressing red button or valve solenoid.	Replace pneumatic declutch valve if defective.
	Clutch not disengaging when air is applied through declutch cylinder.	Inspect all clutch parts (see figure 5-33 and 5-84) for damage and excessive wear.	Replace damaged and excessively worn parts.
Gun does not eject cases and links.	Same as Table 5-9, failure to eject.	Same as Table 5-9, failure to eject.	Same as Table 5-9, failure to eject.

TABLE 5-13. LINK LOADING MACHINE

MALFUNCTION	POSSIBLE CAUSE	ISOLATION	REMEDY
Link loading machine hangs up	Rounds or links not being fed properly or misaligned.	Visually inspect rounds and links for misalignment.	Realign links or rounds.
	Foreign matter in links or faulty links.	Check link for foreign matter and for imperfections in malfunctioning which restrict round insertion.	Replace faulty link or links.
	Clutch slippage.	Measure torque required to rotate handle. Torque must be 60 to 75 inch/pounds.	If torque is not within specified limits, adjust 4 screws (3, figure 4-9). Adjust all 4 screws simultaneously. Do not torque handle beyond limits or damage to links will result.

APPENDIX A
PARTS REPLACEMENT SCHEDULE

A-1. Refer to table A-1 for the schedule of parts replacement.

TABLE A-1. PARTS REPLACEMENT SCHEDULE

Part No.	Part Nomenclature	Figure & Index No.	Replacement Interval (rounds fired)
	Replace parts as required by Inspection		3000
	Replace parts as required by Inspection		6000
1700628	Firing Pin	2, 5-35	
2471092	Spring, Firing Pin	3, 5-35	
2470833	Insulator (Firing Pin)	1, 5-35	
2471043	Clip, Spring (Oscillating Guide)	1, 5-88	
2471066	Poppet, Gas Check Valve	5-76	
	Replace parts as required by Inspection		9000
2471046	Ring, Outer (Ram Piston)	7, 5-81	
2471047	Ring, Inner (Ram Piston)	7, 5-81	
2470864	Orifice, Blast Suppressor	2, 5-12	
	Replace parts as required by Inspection		12,000
	Replace parts enumerated for 6000 rounds fired		
2471255	Holder, Firing Pin	4, 5-35	
2471054	Latch, First Fire (Firing Pin Holder)	5, 5-63	
2471055	Latch, Last Fire (Firing Pin Holder)	5, 5-63	
2471058	Shaft (Firing Pin Holder)	4, 5-63	

TABLE A-1. PARTS REPLACEMENT SCHEDULE (Continued)

Part No.	Part Nomenclature	Figure & Index No.	Replacement Interval (rounds fired)
2470835	Spring (Firing Pin Holder)	3, 5-35	12,000 (Cont)
2470944	Latch, Round Positioner	2, 5-44	
2471052	Retainer, Round Positioner	3, 5-44	
2470945	Spring, Round Positioner	1, 5-44	
2471045	Follower, Cam	1, 5-60	
2471260	Seal, Ring	1, 5-46	
1700619	Washer, Stop, Buffer	6, 5-73	
1700656	Piston, Buffer	5, 5-73	
2537593	Ram Assembly	2, 5-81	
2470846	Spring, Rammer Housing	3, 5-82	
2470847	Spring, Rammer Housing	3, 5-82	
2471091	Nut and Guide, Gas Check Valve	5-76	
	Replace parts as required by Inspection		15,000
2537730	Cylinder, Revolver Assembly (Return for Overhaul)	4, 5-46	
	Replace parts as required by Inspection		18,000
	Replace parts enumerated for 6000 rounds fired and 9000 rounds fired		
2471214	Piston, Rammer	4, 5-81	
2471297	Guide, Oscillating	3, 5-88	
	Replace parts as required by Inspection		21,000
	Replace parts as required by Inspection		24,000

TABLE A-1. PARTS REPLACEMENT SCHEDULE (Continued)

Part No.	Parts Nomenclature	Figure & Index No.	Replacement Interval (rounds fired)
	Replace parts enumerated for 6000 rounds fired and 12,000 rounds fired		24,000 (Cont)
2471383	Positioner Assembly, Round	5-44	
	Replace parts as required by Inspection		27,000
	Replace parts enumerated for 9000 rounds fired		
2051060	Hold Forward Assembly	5-54	
2310644	Switch Assembly, Gun Sequencing	5-38	
2471010	Tube, Gas Transport	10, 5-56	
2471019	Tube, Gas Eject	2, 5-57	
1700620	Key, Cam Follower Lock	1, 5-61	
2471213	Elbow, Gas	10, 5-51	
2471235	Slider	1, 5-86	
2471268	Tube (Air Cooling)	4, 5-39	
2471269	Tube (Air Cooling)	1, 5-49	
2471323	Gun Junction Box Assembly	5-38	
1700657	Stud, Loader Attaching, Aft	4, 5-64	
2471415	Valve, Charger (Return for Overhaul)	6, 5-48	
1633952	Sear Assembly, Rammer	4, 5-87	
1633964	Tube, Declutch	5-74	
2094325	Tube, Buffer (F/F)	1, 5-69	
2094326	Tube, Buffer (L/F)	1, 5-69	
2471113	Tube, Buffer, Common	5-69	
2471114	Tube, Rammer Valve	5-74	
2471345-1	Coupling Half, QD 1/4 in.	4, 5-48	
2471237	Tube, Loader Gas (S)	5-65	
2310652	Housing Assembly, Rammer	6, 5-81	
2051056	Retainer, Ram Damper Spring	5, 5-81	

TABLE A-1. PARTS REPLACEMENT SCHEDULE (Continued)

Part No.	Part Nomenclature	Figure & Index No.	Replacement Interval (rounds fired)
2471160	Valve Body, Manifold	8, 5-77	27,000 (Cont)
2471161	Terminal, Manifold	9, 5-77	
2471044	Pin, Oscillating Guide	2, 5-88	
2470913	Check Valve, Heat Barrier	1, 5-75	
2470915	Gasket, Ram Valve to Manifold	2, 5-75	
2471385	Valve, Rammer (Return for Overhaul)	3, 5-74	
1735725	Valve, Declutch (Return for Overhaul)	6, 5-74	
2471347	Valve, Ammo-Drive (Return for Overhaul)	5, 5-29	
2471320	Valve and Tray Assembly (Return for Overhaul)	6, 5-27	
2208848	Control Box Assembly (Retain for Connector Replacement)	5-8	
DM9708-3S-8	Electrical Connector P205 Charge Valve Plug P206 Rammer Valve Plug P207 Clutch Valve Plug	 1, 5-20 4, 5-15 2, 5-15	
	Replace parts as required by Inspection Replace parts enumerated for 6000 rounds fired and 15,000 rounds fired		30,000
	Replace parts as required by Inspection		33,000
	Replace parts as required by Inspection Replace parts enumerated for 6000 rounds fired, 9000 rounds fired, 12,000 rounds fired, and 18,000 rounds fired		36,000
	Replace parts as required by Inspection		39,000

TABLE A-1. PARTS REPLACEMENT SCHEDULE (Continued)

Part No.	Part Nomenclature	Figure & Index No.	Replacement Interval (rounds fired)
	Replace parts as required by Inspection Replace parts enumerated for 6000 rounds fired		42,000
	Replace parts as required by Inspection Replace parts enumerated for 9000 rounds fired and 15,000 rounds fired		45,000
	Replace parts as required by Inspection Replace parts enumerated for 6000 rounds fired, 12,000 rounds fired, and 24,000 rounds fired		48,000
	Return Mk 11 Gun and Pod Assembly for Overhaul		51,000
2196168	Gun Loader, 20MM Mk 2 Mod 1	2-5	

APPENDIX B
BARREL AND REVOLVER CYLINDER EROSION CHARACTERISTICS

B-1. BARREL AND REVOLVER CYLINDER EROSION CHARACTERISTICS.

B-2. Barrel and barrel insert erosion is primarily a function of burst lengths and burst intervals, and may vary with flight conditions (altitude and speed) and ammunition propellant characteristics. Since these variables exist and Fleet experience with the Gun Pod Mk 4 Mod 0 is not yet available, barrel and barrel insert replacement is controlled entirely by erosion inspection rather than by the number of rounds fired. Erosion is measured after each flight (refer to paragraph 5-16, step 8) to assure that limits have not been exceeded since excessive erosion can result in unstable rounds and produce a safety of flight hazard.

B-3. In service use it is anticipated that the barrel life of 7500 rounds at one-second bursts with three minutes interval will be exceeded. The barrels have been fired on the ground to the above one-second schedule with cooling at mid-podful to 9000 rounds without exceeding erosion limits. During flight tests at schedules of two-second bursts at approximately three minute intervals, a life of 6500 rounds was achieved. A 1-3/4 to two-second burst at intervals no shorter than three minutes is considered typical for an air-to-ground attack.

B-4. Insert life of four podfuls (3000 rounds) can normally be expected at one-second bursts and three podfuls at two-second burst schedules with three minutes interval between bursts. As burst lengths increase and/or cooling periods decrease, or more erosive ammunition is used, erosion and parts life will decrease, which requires that erosion be monitored after each flight. The acceptable erosion limit prior to insert replacement is 0.025 inch (refer to table 5-4) which is sufficiently low to allow additional firing for the next flight. External ballistics are satisfactory up to 0.050 inch of erosion. Since long burst firing induces greater erosion, not more than one 5-1/2 second burst (375 rounds or one-half podful) should be attempted in any one podful. Multiple half-podful bursts may result in a safety of flight hazard.

B-5. The rifled insert in the revolver cylinder is also a key to round stability. The maximum erosion or wear limit (I.D. of lands) is 0.010 inch (at two inches aft of the forward cylinder face) to assure projectile spin velocity. However, overhaul life of the revolver cylinder is not limited now by rifled insert life, but by ring seal seat life (located just forward of the insert), therefore, no special inspection is required for the rifled inserts.

INDEX

PARAGRAPH (Figure) *Table

A

B

INDEX (Continued)

PARA-GRAPH (Figure) *Table

C

D

E

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

PARAGRAPH (Figure) *Table

P

R

INDEX (Continued)